Item 546-D GA1.13: CED-81-46

MAY 7 1981

REPORT BY THE

Comptroller General

OF THE UNITED STATES

ORIGINAL

Better Data Needed To Determine The Extent To Which Herbicides Should Be Used On Forest Lands

The use of herbicides, especially aerial spraying, for managing unwanted vegetation on forest lands has become a public controversy. In some cases their use has been restricted. Growing opposition, stemming from unanswered questions about herbicides' health and environmental effects, could result in further restrictions.

Although it has been shown that nonherbicide methods can be used to control unwanted vegetation in national forests, the extent to which these methods can replace herbicides is not known. Serious information gaps exist relating to the costs of vegetation management methods and their relative effectiveness. Most forests GAO visited had some success with alternatives to herbicides; site-specific data was not available to identify why methods had succeeded in one area but not in another.

GAO is recommending a number of actions that should strengthen the vegetation management decisionmaking process of the Departments of Agriculture and the Interior.

CED-81-46
APRIL 17, 1981

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-197558

The Honorable James H. Weaver
Chairman, Subcommittee on Forests,
Family Farms, and Energy
Committee on Agriculture
House of Representatives

The Honorable Mark O. Hatfield
United States Senate

This report discusses vegetation management programs and practices on forest lands managed by the Department of Agriculture's Forest Service and the Department of the Interior's Bureau of Land Management. The main topics are the use of herbicides, the controversy over herbicides, the controversy's effect on forest land managers, and the need for both agencies to take actions that would provide better information for making vegetation management decisions. We made this review in response to your requests in November 1979.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of the report until 10 days from the date of the report. At that time we will send copies to the Director, Office of Management and Budget; the Secretaries of Agriculture and the Interior; and other interested parties.

Milton J. Socolar

Acting Comptroller General
of the United States

REPORT BY THE
COMPTROLLER GENERAL
OF THE UNITED STATES

BETTER DATA NEEDED TO DETERMINE THE EXTENT TO WHICH HERBICIDES SHOULD BE USED ON FOREST LANDS

D I G E S T

Intensive forest management practices, including the control of vegetation that competes with desired tree species for moisture, soil nutrients, and sunshine, have been recognized as a means to increase timber production. Various vegetation management methods, including mechanical clearing, prescribed burning, herbicides, and manual cutting, are now in use on forest lands. One method--the use of herbicides--has become embroiled in controversy.

GAO's review concentrated on those vegetation management activities at the site preparation and release (the term release refers to promoting the growth of selected trees by temporarily suppressing competing vegetation) stages because it is at these stages in managing a forest when herbicides are generally used. (See p. 1.)

Although opponents have not achieved a total ban on the use of herbicides on forest lands, their efforts have interrupted, reduced, and even stopped aerial spraying and/or the use of herbicides in some areas. Public interest groups' actions, an increasing number of lawsuits, and news media coverage all indicate that the current controversy will continue and will affect forest management practices. (See pp. 7, 9, and 13.)

Additionally, in March 1980 the Environmental Protection Agency began cancellation hearings on 2,4,5-T and silvex, two herbicides widely used for forestry management until their temporary suspension in February 1979. The hearings are expected to continue into late 1981 and will deal extensively with the risks-versus-benefits question. (See pp. 9 and 10.)

Concerted opposition to herbicide use seems to center on public lands in the Northwest.

This may be due to the requirement to publicize State and Federal herbicide programs (through environmental impact statements, for example) as well as the fact that aerial spraying is the primary application method in the Northwest.

Recently, opposition has not been as strong in the South, even though more acres are being chemically treated. In the South, herbicides are generally applied by ground methods.

Serious information gaps exist relating to the total cost of vegetation management methods, their relative effectiveness and the long-term silvicultural and environmental impact of herbicide use. The agencies claim that herbicides are safe if used properly and beneficial (increasing timber harvests). Opponents claim that herbicides are not safe, that they are used excessively, and that benefits are overstated. (See pp. 7 to 12.)

GAO believes that the Bureau of Land Management and the Forest Service could take actions that would provide better information for making decisions on site preparation and release work, reduce some of the current controversy, and at the same time increase the agencies' credibility in dealing with herbicide opponents. Ultimately, a timely resolution of the controversy will probably require cooperative efforts by the herbicide opponents and proponents to fill the information gaps. (See pp. 7 and 13.)

ARE THERE VIABLE ALTERNATIVES TO HERBICIDES FOR SITE PREPARATION AND RELEASE WORK?

Experiences in forest management have demonstrated that alternatives to herbicides for site preparation and release work are viable; it is the extent to which they can replace herbicides that is not known. Most of the forests GAO visited had some success with alternatives to herbicides; however, site-specific data was not available to identify why methods had succeeded in one area but not in another whether it be from one forest

to another or within a forest. The degree to which alternatives can eventually be used to replace herbicides will not be known until more pretreatment and post-treatment site-specific data is gathered and an analysis is made to determine why projects, both chemical and nonchemical, succeed or fail. (See pp. 14 to 31.)

VEGETATION MANAGEMENT DECISIONS NEED IMPROVEMENT

The Bureau's and the Service's recent chemical use policy statements seem more restrictive than previous statements. They imply that nonchemical alternatives should be used whenever possible. Given the subjectivity of the decisionmaking process and the long-standing belief of forestry personnel that herbicides are safe and the most economical and effective method available, GAO questions whether these changes will have any significant effect on the number of acres treated with nonchemical methods. Both agencies have required since the early 1970s that nonchemical alternatives be considered in the decisionmaking process. Herbicide opponents and other observers contend that alternatives have not been adequately considered. (See pp. 32 to 35.)

Site preparation and release work acreage data (exclusive of burning) over the 5-year period 1975-79 (the most recent figures available at the time of GAO's review) indicates that the use of nonchemical methods in relation to chemical methods has not changed significantly. Four of the eight forests and one Bureau district GAO visited used herbicides on a greater percentage of the land treated in 1979 than in 1975, while one forest and one Bureau district showed some reduction and two forests showed a significant reduction in herbicide use. For one forest, information was not available for 1975-78. The significant reduction in the two forests, however, was due to outside influences (county ordinances) rather than management choice. (See p. 35.)

None of the Bureau districts or Service forests visited consistently gathered and documented site-specific pretreatment information or consistently evaluated the various treatment methods used. Such information is needed so that management can not only evaluate its decisions but also compare successful projects with failures to determine why particular methods work in some areas but not in others. (See pp. 40 to 42.)

Currently, no standard, objective criteria exist for deciding whether a stand of trees should be released. The criteria used varied from forest to forest and within forests. (See pp. 38 to 40.)

Service forests and Bureau districts relying primarily on aerial spraying and other herbicide use for site preparation and release work need to increase their use of nonherbicide methods so that these options can be thoroughly evaluated. Increased use of nonherbicide methods would also help fill the major information gaps on the costs and relative effectiveness of various options; provide practical (in the field), site-specific experience in applying nonherbicide methods; provide a logical adjunct to the existing efforts in evaluating vegetation management alternatives; and better enable forests and districts to meet their management goals should the use of herbicides be further restricted. (See p. 42.)

Recommendations

To make sure that options available to carry out site preparation and release work are thoroughly evaluated, the Chief of the Forest Service and the Director of the Bureau of Land Management should ensure that:

--Those forests and districts relying heavily on herbicides increase the use of nonherbicide methods.

--Adequate site-specific pretreatment and post-treatment information is gathered and evaluated.

They should also develop more objective criteria for determining the need for release. (See p. 43.)

AVAILABLE COST DATA NOT SUITABLE CRITERION FOR SELECTING AMONG VEGETATION MANAGEMENT ALTERNATIVES

While costs appeared to be a key consideration, the agencies generally did not make detailed cost comparisons or analyses nor keep records to track the indirect costs associated with the various vegetation management practices.

GAO could not make a detailed analysis of the contract cost data because pertinent information which may influence contract costs was generally not available. For example, factors such as height, quantity, and type of vegetation to be treated; type of terrain; site location and its accessibility; and experience of contractors all have a bearing on the costs per acre. (See pp. 44 and 45.)

Even though a definitive cost analysis was not possible, the data GAO obtained indicated that aerial herbicide spraying may not have as much of an economic advantage over other methods as is generally thought. Also, the cost differential among the methods appears to have narrowed considerably since 1975, which could reduce the importance of budgetary outlays as an issue when deciding which method to use. (See pp. 45 to 51.)

Recommendation

The Service and the Bureau should gather more comprehensive and complete cost data on their site preparation and release projects. (See p. 51.)

AGENCY COMMENTS

The Department of Agriculture said GAO's recommendations will strengthen the decisionmaking process on the use of herbicides for forest vegetation management. The Department of the Interior said its vegetation management decisionmaking process should be strengthened and that

it generally concurred with GAO's recommendations. Both the Departments also commented on other specific issues. Their letters and GAO's responses to these comments are in appendixes IV and V.

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ABBREVIATIONS

BLM	Bureau of Land Management
EPA	Environmental Protection Agency
GAO	General Accounting Office
MMBF	Million board feet

CHAPTER 1

INTRODUCTION

The United States has about 500 million acres of commercial forest land, 1/ of which the Department of Agriculture's Forest Service manages about 91.9 million acres and the Department of the Interior's Bureau of Land Management (BLM) manages 4.8 million acres. Low net energy requirements in extracting and manufacturing forest products, coupled with the forests' renewable nature, are expected to increase wood's importance. Accordingly, significant increases in domestic timber production will be needed to meet projected increases in demand. Intensive forest management practices, including the control of vegetation which competes with the desired trees for moisture, soil nutrients, and sunshine, have been recognized as a means to increase timber production. A wide variety of methods, such as mechanical clearing, prescribed burning, herbicides, and manual cutting, are used to control competing vegetation on forest lands.

Herbicide use plays a significant role in some Service forests' and BLM districts' vegetation management programs. This use has become embroiled in a highly publicized controversy. Because of this controversy and the importance of the Nation's timber resources, Representative James H. Weaver, Chairman, Subcommittee on Forests, Family Farms, and Energy, Committee on Agriculture, House of Representatives, and Senator Mark O. Hatfield asked us to review the Service's and BLM's vegetation management practices, including the use of herbicides. Our review concentrated on those activities at the site preparation and release stages because it is at these stages in managing a forest that herbicides are generally used.

VEGETATION MANAGEMENT ON FOREST LANDS

Vegetation management refers to managing a commercial species of trees to ensure full stocking (desired number of trees per acre) by temporarily suppressing or controlling the growth of competing vegetation--other tree species, brush, or

---

1/The Forest Service defines commercial forest land as land which is producing or is capable of producing crops of industrial wood and which has not been withdrawn from timber use by statute or administrative regulation. It includes both accessible and inaccessible areas generally capable of producing in excess of 20 cubic feet per acre of annual growth.

grass. In managing a forest to achieve desired production goals, certain activities, often referred to as silvicultural practices, are performed during the life of the forest. These activities include, but are not limited to,

--site preparation (done before planting);

--stand maintenance, including release (usually done during the first 10 years of growth);

--precommercial thinning (usually done after 10 to 15 years of growth); and

--commercial thinning (done at various intervals, usually after at least 20 years of growth).

Site preparation involves clearing the land of logging debris and vegetation. This may be done by burning; applying herbicides either from the air or on the ground; 1/ using machines such as crawler tractors with discs, roller drums, or other equipment; and/or hand cutting with chainsaws and axes. Burning is one of the most common methods of getting rid of excess debris. Herbicides are sometimes used to dry the vegetation so that the logged-over area can be adequately burned, as well as for suppressing vegetation so that it does not interfere with tree seedling growth.

"Release" refers to promoting the growth of selected trees by temporarily suppressing vegetation which is competing with the trees being grown and managed for production. If needed, release work is usually carried out 3 to 5 years after the seedlings are planted. Once the selected trees have grown tall or big enough and can compete with other vegetation, they are generally considered released. The need for release work varies substantially depending on such factors as geographic area, land productivity, rainfall, types of competing vegetation, and soil components.

Like site preparation, a variety of methods is available for release work. At the forests and BLM districts we visited, the principal methods used were aerial herbicide spraying in the West and ground herbicide application in the South with some manual cutting in both areas.

1/Herbicides are applied on the ground by either (1) hand or mechanical spraying, (2) distributing grid balls--dry pellets that crumble when hit by rain, or (3) injecting individual trees, which is the most common method.

Thinning, whether precommercial or commercial, refers to cutting and/or removing some trees to stimulate the growth of others. This activity increases the total yield of useful material by concentrating the stand's potential wood production on a limited number of selected trees. Thinning may be carried out by hand, with machines, or with herbicides (injecting individual trees).

HERBICIDE USE DATA

The Service and BLM began using herbicides in the 1940s and 1950s, respectively, although extensive use did not occur until the 1960s. The following tables show acreage, the amount of herbicides used on Service lands in fiscal year 1979 by region, and the purpose for which it was applied.

Use of Herbicides on Forest Service Lands, by Region
Fiscal Year 1979 (Note a)

	Region (note b)	Quantity		Land area	
		Pounds	Percent	Acres	Percent
1	Northern	16,074	3	8,429	5
2	Rocky Mountain	28,507	6	12,161	7
3	Southwestern	5,208	1	2,217	1
4	Intermountain	28,787	6	17,224	9
5	Pacific Southwest	87,232	19	24,779	14
6	Pacific Northwest	49,256	11	19,946	11
8	Southern	188,211	40	69,375	38
9	Eastern	61,961	13	27,957	15
10	Alaska (note c)	-	-	-	-
	Total	465,236	d/99	182,088	100

a/Figures are approximate but totals are slightly different from those reported in the Service's fiscal year 1979 pesticide use report.

b/There is no region 7.

c/No Service data on region 10's herbicide use.

d/Does not total 100 percent due to rounding.

Purposes for Which Herbicides Were Used
on Forest Service Lands
Fiscal Year 1979

Purpose	Quantity		Land area	
	Pounds	Percent	Acres	Percent
Site preparation	145,535	31	49,981	27
Release	96,412	21	37,457	20
Noxious weeds	48,491	10	24,891	13
Thinning	57,892	12	21,688	12
Other	41,967	9	19,782	11
Range	31,581	7	18,943	10
Right-of-way	34,248	7	11,762	6
General weed	15,011	3	3,096	2
Total	471,137	100	187,600	a/101

a/Does not total 100 percent due to rounding.

Detailed BLM statistics on herbicide use by acreage and area of application were not available at the time of our review. However, BLM records showed that in fiscal year 1979, 22,683 acres in Oregon were sprayed with 39,953 pounds of herbicides for site preparation and release.

OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of our review were to determine (1) the agencies' experience with using the various methods to control competing vegetation, (2) current efforts to evaluate the feasibility of using alternatives to herbicides to control vegetation, and (3) the costs of using herbicides compared with the costs of alternatives to control vegetation.

We reviewed legislation, regulations, and procedures relating to Service and BLM vegetation management programs and policies, including the use of herbicides. We interviewed Forest Service officials, including field personnel at the regional, forest supervisor, and district office levels and at research experiment stations; BLM officials, including field personnel at the State and district office levels; and Environmental Protection Agency (EPA) officials at headquarters. We also discussed the use of herbicides on forest lands with private timber company officials, State forestry officials in Oregon and Washington, and university officials in Oregon. In addition, we interviewed and gathered information from several public interest groups concerned with the use of herbicides on forest lands.

The forests and districts included in our review were selected using one or more of the following criteria.

--Relatively large use of herbicides for vegetation management during site preparation and/or release work.

--Experience with nonherbicide vegetation management methods for site preparation and/or release work.

--Involvement in the herbicide use controversy.

Detailed fieldwork was done at the following national forest supervisor offices and at selected district offices.

National Forest	Location
Region 5:	
Klamath	Yreka, California
Shasta/Trinity (note a)	Redding, California
Region 6:	
Siuslaw	Corvallis, Oregon
Willamette	Eugene, Oregon
Region 8:	
Francis Marion/Sumter (note a)	Columbia, South Carolina
Ouachita	Hot Springs, Arkansas

a/Two separately proclaimed national forests administered as one unit under one forest supervisor.

The three regions accounted for 70 percent of the herbicides used on Service lands in fiscal year 1979. We also did fieldwork at the BLM district offices in Eugene and Medford, Oregon. Most of BLM's use of herbicides occurs in Oregon.

At the field offices, we reviewed and gathered information primarily on

--the decisionmaking process related to (1) the type(s) of vegetation management needed on specific units of land, (2) the method(s) to be used to carry out the vegetation management desired, and (3) the extent to which alternatives to herbicides were considered;

--the successes and failures of the various methods experienced by individual forest and BLM district managers in carrying out vegetation management; and

--the costs of the various vegetation management methods.

We believe the cost data we were able to gather may be indicative of what has been happening and what may happen in the future in terms of the costs of the various methods available to treat competing vegetation. However, until more refined cost data is compiled by the agencies, great care needs to be exercised in making detailed conclusions or exacting comparisons about the costs of various vegetation management practices.

We did not attempt to resolve the risks-versus-benefits question. EPA is currently holding cancellation hearings on 2,4,5-T and silvex, two of the most popular herbicides used for forestry management until their temporary suspension in February 1979. While these hearings are not expected to resolve all risks-versus-benefits questions because they are specific to the two herbicides involved, the issues are to be dealt with extensively. The hearings began in March 1980 and are expected to continue into late 1981.

Our detailed work was limited mostly to vegetation management activities at the site preparation and release stages because herbicides are generally used at these stages of forest management. We gathered information, where readily available, for fiscal years 1975-79.

The Departments of Agriculture and the Interior were given a draft of this report for review and comment. Both Departments' comments (see apps. IV and V) have been incorporated in the report where appropriate.

CHAPTER 2

THE CONTROVERSY OVER RISKS AND BENEFITS OF HERBICIDE USE WILL CONTINUE TO AFFECT FOREST MANAGEMENT DECISIONS

The current controversy over herbicide use, especially aerial herbicide spraying, on public forest lands is expected to continue and will, in our opinion, have an impact on future forest management. The controversy, nurtured by a lack of convincing and verifiable data (both pro and con), is heightened by an atmosphere of strong emotions, distrust, and cynicism. Serious information gaps exist relating to the total cost of vegetation management methods, the relative effectiveness of those methods, and the long-term silvicultural and environmental impacts of herbicide use. The agencies claim that herbicides are safe if used properly and beneficial (by increasing harvests). Opponents claim that herbicides are not safe, that they are used excessively, and that the benefits are overstated. Timely resolution of the controversy will probably require cooperative efforts by the herbicide opponents and proponents to fill the information gaps.

PUBLIC CONCERN ABOUT HERBICIDE USE

Public concern, both pro and con, about herbicide use has steadily increased since the early 1970s. More recently, it has become an extremely emotional issue. Proponents express fears about reduced forest productivity as well as job and income losses. Their position has been supported in defeats of anti-herbicide referenda in at least three California and Oregon counties and in petitions avowing support for continued safe use of herbicides. For example, in May 1980 BLM's Medford district received a 1,600-signature petition supporting the use of herbicides. Opposition arguments center around health hazards--past and present (alleged and documented) as well as future. The opponents have claimed at least one significant victory by the enactment of an anti-herbicide ordinance in one California county. According to EPA's Deputy Assistant Administrator for Pesticide Programs, the controversy has some merit on both sides--those using herbicides and those unwillingly exposed to herbicides.

Concerted opposition to herbicides seems to center around herbicide use on public forest lands in the Northwest. This may be due to the requirement to publicize State and Federal herbicide programs (through environmental impact

statements, for example) as well as the fact that aerial spraying is the primary herbicide application method in the Northwest. Recently, opposition has not been as strong in the South, even though more acres are being chemically treated. However, the herbicides in the South are generally being applied by ground methods.

Complaints about the agencies' use of herbicides to control unwanted vegetation include:

--Herbicides--especially phenoxy herbicides 1/--are dangerous to humans, animals, and the environment in general.

--Aerial herbicide spraying has resulted in individuals being unwillingly exposed to herbicides through air and water contamination.

--Because of its relatively low cost (at least in the past) and ease of application, aerial herbicide spraying has been used when it was not really needed.

--The lack of site-specific criteria for determining the need for release has resulted in aerial spraying where it was not needed.

--The agencies have not adequately considered alternatives to herbicides.

--The agencies have not considered the total costs of using herbicides in their decisionmaking processes.

--The agencies do not really know the dangers involved with herbicide use and cannot accurately measure the benefits.

EPA is responsible for determining the safety and use of herbicides, but it is highly unlikely that it will resolve the current controversy in the foreseeable future. Each chemical is evaluated or reevaluated individually--a process that can take EPA a number of years--and numerous chemicals are used on forest lands.

1/Phenoxy refers to any chemical in a group of herbicides classified as chlorinated arloxyalkanoic acids. Herbicides in this group that have been used on forest lands include 2,4-D; 2,4-DP; 2,4,5-T; silvex; and to a minor extent, 2-methyl-4-chlorophenoxyacetic acid (MCPA).

Although opponents have not achieved a total ban on herbicide use on forest land, their efforts have interrupted, reduced, and even stopped aerial spraying and/or use of herbicides in some areas. Public interest groups' actions, an increasing number of lawsuits, and news media coverage all indicate that the current controversy will continue and will affect those managing our forest resources. Forest managers must consider this controversy in deciding how to control unwanted vegetation. The following examples show how the controversy has affected herbicide use on forest lands.

--In 1971 Ouachita National Forest stopped aerial herbicide spraying for site preparation and release because of a change in its tree regeneration program from aerial seeding to hand planting, and growing public opposition to aerial spraying.

--On June 20, 1975, a Federal court issued a temporary injunction banning all herbicide use on forest lands in the Ozark and St. Francis National Forests. The ruling, on a suit brought by a local wildlife club, was based on an inadequately prepared environmental impact statement. In February 1979 an agreement was reached permitting ground application of most herbicides.

--In 1975, following the court injunction described above, the Forest Service's Southern region stopped aerial spraying in the national forests except for rights-of-way by permittees.

--In 1976 Trinity County, California, which contains a large portion of the Trinity National Forest, passed an ordinance prohibiting aerial spraying with 2,4-D, silvex, or 2,4,5-T without a permit. In 1979 the county passed two more ordinances banning the use of all phenoxy herbicides and restricting the use of all herbicides, pesticides, or chemicals that could be hazardous. Service officials told us that only one permit has been granted and that the total number of acres released since 1976 has dramatically decreased.

--In June 1980 two other California counties that contain national forest lands held referenda on banning herbicide use. Although the referenda were defeated, the vote in one county was described by a Service official as rather close. Two anti-herbicide referenda in Oregon were decisively defeated in November 1980.

--In 1979, after following up on reports of human miscarriages caused from spraying in the Northwest, EPA

placed a temporary suspension (which is still in effect) on the use of 2,4,5-T and silvex for forestry and other purposes. These two chemicals were the most widely used on forest lands and were considered by some to be the most effective. Cancellation hearings on these chemicals began in March 1980 and are expected to continue into late 1981.

--Lawsuits or administrative appeals against both BLM and the Service have on different occasions resulted in long delays in carrying out spraying activities, cancellation of spraying contracts, and in one case some damage payments. 1/

--Because of opposition to herbicides, Service officials estimated that at three of the forests included in our review, only 40 percent of the total release needed was being carried out.

In addition, news media coverage on the possible harmful effects of using chemicals has been extensive, which in turn increased public concern. Also, claims seeking damages for human suffering caused by herbicide use are pending.

BENEFITS OF HERBICIDE USE

Vegetation management is based on the premise that some benefit will accrue if man aids the natural process of crop tree regeneration--by planting superior crop trees and/or suppressing competing vegetation. The parties seem to be in basic agreement with this premise. Disagreements arise, however, over the extent of the benefits; the price--human, environmental, and dollar--to be paid for the benefits; and the methods to be used to achieve the benefits.

Studies on benefits of chemicals

Several studies and estimates, five of which are presented below, have attempted to quantify the benefits of using herbicides.

1/Claims were filed for damages ($135,000) to Alabama cotton crops caused by aerial spraying in 1969. Although records were not available, Service officials said the Service and a Federal crop insurance program paid about $35,000 to settle the claims.

1. 1980 Siuslaw National Forest study

   a. If only nonphenoxy herbicides were used, there would be little or no yield reduction, but total reforestation costs would increase 15 percent.

   b. If no chemicals were available, 24 percent of the forest might not achieve minimum reforestation standards, and timber yield could decrease 35 percent during one forest rotation cycle (time between harvests).

2. 1976 Ozark and St. Francis National Forests' analysis of vegetation management without herbicides 1/

   a. Roadside brush control costs increased from $18.50 to $100 a mile.

   b. Site preparation costs increased by 50 percent.

   c. Release costs more than doubled and some release work could not be done at all.

   d. Cost increases and productivity losses for these forests would exceed $1 million annually without herbicides.

3. Forest Service Pacific Northwest analysis (projections of not using herbicides on four types of brush west of the Cascade Mountains)

   a. An annual cost increase of $6 million to $14 million, annual timber yield decline of 110.4 million board feet (MMBF), and loss of 73 jobs.

   b. At current budget levels (no $6 million to $14 million increase), the annual timber yield decline would be 538.2 MMBF and the job loss would be 3,750.

1/The Ozark and St. Francis National Forests are two separately proclaimed national forests located in Arkansas and administered as one unit under one forest supervisor.

4. Assessment measuring the national impact of prohibiting the use of 2,4,5-T 1/

   a. Forest owners' cumulative 10-year losses:

      --Increased management costs of $135 million.

      --Reduced income from timber sales of $666 million.

      --Net income loss of $801 million.

5. 1979 Forest Service/Oregon State Department of Forestry report on effects of 2,4,5-T prohibition in Oregon

   a. A loss of 20,000 jobs.

   b. Annual timber yield reduction of 936 MMBF.

   c. Decline in forest net worth of $0.4 billion to $1.1 billion.

Except for the assessment measuring the national impact of prohibiting the use of 2,4,5-T, most of the studies estimating benefits from herbicide use have been regional in scope. Some of the Service estimates have been severely criticized. For example, an economist hired by herbicide opponents and two foundations issued two reports on the 1979 Forest Service/Oregon State Department of Forestry study of the effects of 2,4,5-T prohibition in Oregon. The economist generally discounted the study's conclusions because, according to her, it included improbable assumptions, suspect projections, and a dramatically inflated discount rate, and lacked statistical tests and control groups. The Service has, in turn, questioned the economist's analysis. However, the Service has stated in its justification for vegetation management studies that "critical quantitative comparisons of currently used practices are inadequate and promising alternatives need evaluation."

1/"The Biologic and Economic Assessment of 2,4,5-T," a joint study by the Department of Agriculture, EPA, and several State land grant universities released in 1979. The Service is currently reviewing the data presented in this assessment.

CONCLUSIONS

Although opponents have not achieved a total ban on herbicide use on forest lands, their efforts have interrupted, reduced, and even stopped aerial spraying and/or other herbicide use in some areas. Public interest groups' actions, an increasing number of lawsuits, and news media coverage all indicate that the current controversy will continue and will affect those managing the Nation's forest resources.

Although we are not in a position to say whether the risks of using herbicides outweigh the benefits derived from them, we believe BLM and the Service could take actions which would provide better information for making decisions on site preparation and release work, reduce some the current controversy, and at the same time increase the agencies' credibility in dealing with the herbicide opponents. These actions and other matters are discussed in the following chapters.

AGENCY COMMENTS AND OUR EVALUATION

Although the Department of the Interior agreed that the herbicide controversy has greatly affected forest management decisions, it said our conclusions do not accurately reflect the feelings of the general population. (See app. V.) As far as we know, no studies have been made of the general population's feelings on the herbicide issue. We believe, however, that those opposed to herbicides will continue that opposition and will have an effect on forestry management decisions unless those agencies that use herbicides can better justify their decisions.

CHAPTER 3

ARE THERE VIABLE ALTERNATIVES TO HERBICIDES FOR SITE PREPARATION AND RELEASE WORK?

Answering this question is as difficult as answering the risks-versus-benefits question concerning herbicides. Any answer must be prefaced by the fact that major information gaps exist on the (1) actual costs of using the various methods, (2) costs relating to differences in site characteristics (such as access to area and volume of competition), and (3) results of practical application and experience, including successes and failures, of using alternatives and in many cases herbicides. Research is needed not only to fill these information gaps but to improve the effectiveness of alternatives to herbicides and make them more applicable to more areas.

We believe that because of the information gaps and limited experience in using alternatives to herbicides at the forests and districts visited, it would not be possible for these Service and BLM units to immediately replace herbicides with alternatives. 1/ Therefore, should the use of herbicides be further restricted or banned, some site preparation and release work would probably not be completed; this could--and according to the Department of the Interior, definitely would--reduce future timber supplies. On the basis of our review at the eight forests and two BLM districts, however, we believe that opportunities exist for both agencies not only to provide valuable information and experience with alternatives more acceptable to the herbicide opponents, but in time also to reduce their dependence on herbicides in general and aerial application of herbicides in particular. To promote these opportunities, however, the following conditions must be recognized.

--By increasing the use of alternatives to aerial herbicide spraying and herbicides in general, costs for some methods will probably be greater, although

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1/Although prescribed burning is an alternative, the potential for increasing its use in place of herbicides is very limited because, according to Service officials, it is being used as much as possible within environmental and climate limitations. Accordingly, we did not consider it as an alternative. However, BLM believes it is a promising alternative in reducing the use of herbicides. (See app. V.)

data indicates that aerial herbicide spraying may not have as much of an economic advantage over other methods as is generally thought. (See pp. 44 to 51.)

--Any efforts to evaluate and gain experience with methods to carry out site preparation and release work must be long term. Short-term projects are not going to withstand close scrutiny because of the long time needed to establish a good stand of trees. Also, release is generally carried out during the first 10 years of growth after planting, and another 2 years may be needed to properly determine the effectiveness of the method(s) used. Questions relating to effects of methods over the life of a forest would have to become part of much longer projects.

--Some forest personnel involved in site preparation and release work decisions will need to change their basic thinking that using herbicides is the only way to do it.

The extent to which forests and BLM districts could begin to rely on alternatives to aerial and other herbicide use for site preparation and release work will vary depending on such factors as steepness of slope, type and age of vegetation being treated, budgetary restrictions, experience with alternatives, and ability to overcome problems of the particular land being managed. The degree to which alternatives can eventually be used to replace herbicides will not be known until more site-specific data is gathered on the (1) most important factors which supposedly influence decisions as to what method(s) to use and (2) success and failure of projects using different methods. Most of the forests visited had some success with alternatives to herbicides; however, site-specific data was not available to identify why methods had succeeded in one area but not in another, whether it be from one forest to another or within a forest.

The following is a discussion of the site preparation and release work activities carried out at the forests and BLM districts we visited, agency officials' evaluations of those activities, and our views on opportunities to increase use of nonherbicide methods.

KLAMATH NATIONAL FOREST

The Klamath National Forest in northern California has classified about 1.1 million acres of its 1.7 million acres of forest land as commercial timber land. During the 1975-79 period, this forest relied primarily (exclusive of burning)

on mechanical methods for site preparation work and aerial herbicide spraying for release, as shown in the following table.

Activity and year	Herbicides		Mechanical	Manual
	Aerial	Ground		
	(acres)			
Site preparation:				
1975	0	0	1,729	0
1976	476	0	2,057	60
1977	0	0	866	0
1978	0	0	2,346	0
1979	1,101	0	756	0
Release:				
1975	2,151	0	0	0
1976	4,027	0	0	0
1977	2,176	0	0	0
1978	908	0	0	329
1979	1,406	119	0	19

As the table indicates, only recently had this forest used alternatives to its primary methods of controlling competing vegetation. One contract for manual site preparation was completed in 1976, three for manual release in 1978, and one for manual release in 1979. One ground herbicide application project was completed in 1979.

Forest officials had not uniformly and consistently evaluated the success or failure of site preparation and release projects. Nonherbicide projects had not been formally evaluated while evaluation of aerial herbicide projects had been left to each district. The three districts we contacted varied in the formality of their evaluations and documentation. For example, one district had not formally evaluated its spray projects while another made before and after surveys and summarized the results in a memorandum to the file.

Officials' opinions regarding the success or failure of the methods used were as follows.

--Mechanical site preparation has been generally successful but can be used only on slopes of 35 percent or less.

--Aerial herbicide spraying has generally been successful but retreatment has been necessary on 20 to 30 percent of the land sprayed.

--manual projects appear to have been successful in the short run but repeated treatments will be needed for long-term success because resprouting occurs and the competing vegetation overtakes the conifers, or cone-bearing trees.

Opportunities to reduce the aerial spraying and other herbicide use appear to be limited to manual methods and ground application of herbicides because mechanical methods are already used for site preparation work and generally are not suitable for release work. The major problems to overcome in increasing the use of these methods are costs, lack of a labor force, resprouting, and steep slopes. In 1979 the forest advertised for bids on 10 ground herbicide contracts. Of these, four received bids and were awarded, four received no bids, and two received bids exceeding allocated funds and therefore were not awarded. According to a forest official, three of the four contracts that were awarded were behind schedule due to difficulty in finding people willing to work with chemicals. Whether or not these problems can be resolved remains unanswered.

SHASTA AND TRINITY NATIONAL FORESTS

The Shasta and Trinity National Forests in northern California, comprised of about 2.1 million acres, are administered as one unit by the forest supervisor in Redding, California. Although 550,000 acres have been designated as good timber-producing land, timber management on 100,000 acres has been prevented by lawsuits; timber production has been prevented on 50,000 acres designated as wilderness areas; and 75,000 acres are being studied for possible inclusion in wilderness primitive areas. This leaves about 325,000 acres available for intensive timber management.

During the 1975-79 period, these forests relied primarily (exclusive of burning) on mechanical methods for site preparation and aerial herbicide spraying for release, as shown in the following table.

Activity and year	Herbicides		Mechanical	Manual
	Aerial	Ground		
	(acres)			
Site preparation:				
1975	0	0	2,221	0
1976	744	0	2,319	0
1977	0	0	1,970	13
1978	0	0	5,294	20
1979	0	305	3,483	49
Release:				
1975	2,731	0	0	0
1976	5,948	0	0	0
1977	0	0	0	119
1978	0	0	596	79
1979	100	0	0	0

Local ordinances eliminated most aerial spraying after 1976. Since then, the forests had used aerial spraying only for an experimental project in 1979. As the table shows, only minimal release work had been done after 1976. These forests apparently took the position that unless herbicides were available, there were no alternatives, at least for release.

As of September 30, 1979, these forests had about 37,600 acres of reforestation backlog. Generally, backlog areas are heavily covered with brush. Forest officials said that attempting to use manual methods in densely covered areas will be extremely costly and, because the root system is not destroyed, the resprouting will be vigorous.

Formal evaluations and documentation of the success or failure of methods used for site preparation and release work were limited. Documented evaluations were not available for aerial spraying projects which, except for the 1979 experimental project, stopped after 1976. Evaluations of mechanical methods had been limited to daily monitoring of contractor performance. This type of monitoring, however, does not provide data on a method's success or failure in terms of enhancing timber growth. Formal evaluations and documentation of manual methods were generally unavailable.

Officials' opinions regarding the success or failure of the methods used were as follows.

--Mechanical methods for site preparation have been the most preferred and usually the most effective, but they are limited to slopes under 35 percent.

--Aerial herbicide spraying had been generally effective. The officials declined to comment on the need for retreatments because, except for the experimental project in 1979, aerial spraying had not been used since 1976. One district official, however, told us that if spraying was carried out in the first 3 years after planting, there would be a 50-percent chance of not having to respray. He said that if the first treatment was not carried out until after 3 years, there was a 90-percent chance that retreatment would be needed.

--Ground application of herbicides can at times give good results, but most areas that would benefit are on grounds with steep slopes and poor access.

--Some manual projects have been successful, but costs and time involved were the major drawbacks.

Opportunities to increase the use of nonherbicide methods for site preparation work appear to be limited. Manual methods are generally considered impractical for site preparation work, and these forests already use mechanical methods extensively. The forests have had success with mechanical methods, but they are costly and limited to slopes under 35 to 40 percent.

Opportunities also appear to exist for more nonherbicide release work, although budgetary and resprouting problems would have to be addressed. The success of manual release projects in terms of the need for retreatment has varied. One district official considered two manual release projects in his district to be successful because further release would not be needed. Another district official rated his experience with manual release methods as successful but also noted that retreatments are generally necessary. A third district which used manual release on a 7-year-old plantation will probably have to re-treat the area.

Data was not readily available to compare the successful projects with the one needing retreatment. Without such data, it is difficult to evaluate why one project is successful and another is not. One problem with the release project on the 7-year-old plantation may have been the timing because release generally is done 3 to 5 years after planting. Longer intervals between planting and release can result in heavy, dense growth with a greater number of stems (competing tree or brush stems which have to be treated to free crop trees), thus reducing the chance of success with manual methods.

SIUSLAW NATIONAL FOREST

The Siuslaw National Forest in the northwest coastal area of Oregon has about 557,000 acres of highly productive forest land. Except for burning, this forest had relied almost exclusively on aerial herbicide spraying for site preparation work. Herbicides had been used in conjunction with burning to aid the burning rather than as an alternative.

During fiscal years 1975-79, site preparation work (except for burning) was carried out as follows: aerial herbicide spraying--12,485 acres; mechanical--229 acres; manual--3 acres. Siuslaw officials believed that mechanical methods, manual brush removal, or ground-applied herbicides were not practical alternatives to aerial spraying for site preparation work. In fact, mechanical methods were not even listed in the alternatives considered for site preparation work in the forest's 1980 environmental assessment. According to an official, mechanical methods were not considered because they would cause erosion problems on the steep slopes; mechanical methods would be limited to slopes under 35 percent. In addition, ground application of herbicides was not thought to be practical because salmonberry--the major problem vegetation--can be suppressed or killed only with broadcast spraying, which generally drenches the applicators. Because of resprouting and brush density, manual methods had not been used for site preparation work.

Most release work had also been carried out by aerial herbicide spraying, although ground-applied herbicides and manual methods to control vegetation had been used to a limited extent. During fiscal years 1975-79, release work at this forest was carried out as follows: aerial herbicide spraying--14,713 acres; manual--3,899 acres; ground herbicide--741. Opportunities to increase methods other than aerial spraying would appear greater for release work than for site preparation work. Budgetary outlays would probably increase, however.

Forest officials noted that using manual methods on salmonberry for release work was not practical because of resprouting. However, experience has shown that manual methods for release are feasible for suppressing red alder and, according to one Siuslaw report, 79 percent of release work on the forest during fiscal years 1977-79 had been to control red alder. During the years covered by our review (1975-79), only in 1979 did this forest attempt to use ground-applied herbicides for release work. According to one ranger district's post-herbicide-use evaluation, the method was effective in treating the red alder.

The successes and failures of the methods used at this forest, like other forests, had not been formally evaluated and documented. This forest, however, had prepared annual post-herbicide-use evaluation reports on aerial spraying of selected units. Although these evaluations had been prepared for a number of years, the data gathered had not been formally evaluated to analyze the aerial spraying program's overall effectiveness. The reports on some units sprayed in 1978 and 1979 showed that herbicide application generally resulted in suppressing competing vegetation. At the same time, however, the reports showed that some conifers were damaged, some units required respraying, and some of the areas sprayed did not need release. Because of incomplete and inconsistent report data, the problems could not be quantified. Officials said that about half the acreage treated with chemicals for release would require retreatment. Nonherbicide methods were not formally evaluated.

Although opportunities to reduce dependence on aerial spraying in this forest appear to rest with ground-applied herbicides and more manual release work, the degree to which these could be used is impossible to predict simply because of the lack of experience with and data on the use of alternatives.

WILLAMETTE NATIONAL FOREST

The Willamette National Forest, comprised of 1.7 million acres (about 1.1 million acres designated as forest land) on the west slope of Oregon's Cascade Range, has the highest sustained yield of any forest in the national forest system and provides a full range of multiple-use benefits. The following table shows the site preparation and release work for 1975-79, excluding burning.

Activity and year	Aerial herbicides	Mechanical	Manual
	(acres)		
Site preparation:			
1975	0	239	0
1976	0	185	0
1977	0	266	0
1978	0	507	0
1979	597	301	550
Release:			
1975	0	0	0
1976	0	0	0
1977	0	0	0
1978	173	0	358
1979	328	0	1,582

According to forest records, aerial herbicide spraying was to be used on 1,517 acres and ground-applied herbicides on 840 acres in 1980.

As the table shows, this forest relied on mechanical methods for site preparation work until 1979. Also, it did not do any release work during 1975-77. According to a Willamette official, aerial herbicide spraying is now used for site preparation because the forest is reforesting higher elevation sites where mechanical equipment cannot be used because of steep slopes. Previously, the forest concentrated on lower elevations which were easier to work with and were generally not very steep. Also, release work was not done until 1978 because the forest's former timber management plan did not recognize the importance of intensive management practices and the benefits that could be derived from them in terms of increasing allowable harvest levels. As a result of increasing its aerial herbicide spraying, this forest may become embroiled in the herbicide controversy.

Formal evaluations had not been made of the manual methods used in this forest. Annual post-herbicide-use evaluation reports had been prepared on some units included in the 1978 and 1979 spraying programs. The information was not quantified and, therefore, not easily compared. However, we noted the following.

--One district reported that of 442 acres sprayed in 1979, 401 acres, or 91 percent, needed retreatment. The other districts did not report whether

retreatment was needed, but most indicated only minor control of the competing vegetation.

--Some reports showed that some trees in the units sprayed did not need treatment, but this information was not quantified nor was it explained whether the trees not needing treatment were together or widely dispersed in the total area sprayed.

--Minor damage was noted on some conifers.

The assistant forest supervisor said that experience with aerial and ground herbicides and manual methods of treatment was very limited and that until a data base is developed, no one could determine the effectiveness of particular methods or when and how often a particular unit (whether herbicide or manually treated) would need retreatment. The forest began collecting information for such a data base in 1978 and the official noted that, as the data base grows, the forest will be able to determine the most effective method for controlling vegetation.

This forest, like other forests, lacks experience and an adequate data base on using all vegetation control methods. Mechanical methods have been used but, as in other forests, their use is limited to certain slopes, depending on their steepness, unless erosion problems can be solved. Whether or not manual methods can be used more remains to be seen. Also, according to the forest's 1979 environmental analysis, this forest had between 6,000 and 7,000 acres of backlog which, because of the dense brush, makes the use of alternatives to aerial spraying extremely costly and less effective. According to the herbicide-use evaluation reports, however, the effectiveness of aerial spraying in this forest had varied widely from project to project.

FRANCIS MARION AND SUMTER NATIONAL FORESTS

The Francis Marion and Sumter National Forests, comprised of seven ranger districts, are administered as one unit by the forest supervisor in Columbia, South Carolina. The two forests have about 523,000 acres, all in South Carolina. Of this amount, 500,000 acres have been designated as productive forest land. Site preparation has been carried out mostly by ground herbicide methods, although some mechanical and a very minimal amount of manual work was done. All release work had been performed with ground herbicide methods, primarily hand injectors.

Opportunities to reduce these two forests' use of herbicides rest with mechanical site preparation and manual release methods. Officials agreed that more mechanical site work could be done and believed that the number of acres prepared by this method would increase in the future. They said that mechanical methods can reduce planting costs as well as reduce or eliminate the need for future release work.

The officials did not know if aerial herbicide spraying had ever been used or, if so, when it was stopped. However, they maintained that it would be the most effective and least costly method to use but said that it was not being used because of public opposition. Ground application of herbicides had been the predominant method used for site preparation and release work and, according to the officials, had been very successful although workers sometimes missed stems. Only a small amount of release work had been needed and generally only when herbicides or manual methods had been used for site preparation. Mechanical site preparation could be used more although the officials contended that it should not be used on slopes steeper than 20 percent.

Officials at these forests generally discounted the use of manual vegetation control methods because of costs and resprouting problems. In addition, the officials noted the danger of using chainsaws. However, one district used manual methods (chainsaws and axes) numerous times since 1975 for its site preparation work for pine regeneration. Resprouting was not considered a serious problem although it was estimated that some areas would need one release treatment. At our request, district officials inspected sites involving about 757 acres where chainsaws and cutting tools had been used to complete the site work. They estimated that about 64 percent of the acreage would need release work while the remainder would not.

Formal written evaluations of the methods used to control unwanted vegetation were not available. Officials said that formal evaluations of the herbicide programs were discontinued about 5 years ago because the evaluations became routine and did not provide any new information. They said that district personnel inspect new plantings within 1 year, and if they determine further work is required, this is documented.

OUACHITA NATIONAL FOREST

The Ouachita National Forest in west central Arkansas and Southeastern Oklahoma has classified 1.5 million of its

1.6 million acres of forest land as productive. Since 1971, when aerial spraying was stopped, this forest had relied primarily (exclusive of burning) on ground herbicide methods for site preparation and release work although it had done a fair amount of mechanical site preparation work and a limited amount of manual release work.

According to forest officials, aerial spraying was stopped in 1971 because of (1) a change from aerial seeding to hand planting, which required better seedbed preparation, (2) the small amount of release work needed, (3) the damage the spray inflicted on hardwoods left along streams and other areas, and (4) the increasing public opposition to aerial spraying.

Since 1971 various methods, including hand spraying, had been used to apply herbicides on the ground. Hand spraying was discontinued in 1977 because officials feared the danger of the herbicides drifting onto the pine and stunting their growth. In 1979 this forest (exclusive of burning) treated over 13,000 acres with herbicides for site preparation and release. Recently, this forest began experimenting with a herbicide pellet which can be applied aerially or on the ground. The pellet, which crumbles when hit by rain, was used for 1,500 acres of release and 180 acres of site preparation in 1980. The pellets were applied by helicopter and by hand.

Mechanical techniques, if carried out correctly, are considered the most effective method in this forest for site preparation and generally eliminate any need for release. Officials estimate that, overall, release is needed on only 20 percent of the forest's new plantings. However, the officials also noted that they were using mechanical methods less than before because it had become more expensive and that escalating costs may reduce future efforts also. The officials also noted that because of potential erosion problems, mechanical site preparation was generally limited to slopes no steeper than 20 to 30 percent. One official noted, however, that a private timber company in the area used mechanical methods on 50- to 55-percent slopes and that the company evidently did not share the Service's concern that this presented an erosion problem.

Manual methods to control vegetation had been used sparingly. Costs and resprouting problems were cited as the reasons for limited use.

Districts in this forest had not been required to formally evaluate herbicide projects. In addition, the success or failure of nonherbicide projects was generally

not documented. Officials' opinions on the effectiveness of the methods used in this forest were as follows.

--Mechanical site preparation is the most effective method but is limited to slopes no steeper than 20 to 30 percent.

--Ground herbicide methods are less costly than manual methods and are generally very effective; however, stems are sometimes missed in the treatment process.

--Manual methods can be used but are costly and generally will require at least two treatments because of resprouting, compared with one treatment when herbicides are used. In addition, chainsaws can be hazardous to operate.

--It is too early to reach any conclusions about the effectiveness of herbicide pellets.

Opportunities to reduce herbicide use in this forest would come through increasing the use of mechanical techniques for site preparation and manual techniques for release. The major problems needing resolution are (1) costs, (2) labor, if manual projects were increased substantially, and (3) erosion, if mechanical methods were to be used on slopes steeper than 30 percent.

BLM MEDFORD AND EUGENE DISTRICTS

Like most of the forests visited, the two BLM districts relied heavily (exclusive of burning) on aerial herbicide spraying for site preparation and release work, although use of nonherbicide methods had increased in recent years. Also, like the forests, no formal evaluations of the success and failures of the methods used had been prepared.

The following tables show the various methods the two BLM districts used for site preparation and release work.

Medford District

Fiscal year	Release using herbicides		Site preparation		
	Aerial	Ground	Aerial herbicides	Mechanical	Manual
	(acres)				
1975	0	0	0	0	0
1976	215	183	185	15	0
1977	234	0	185	50	35
1978	0	0	0	467	0
1979	1,138	0	341	645	0

Eugene District

Fiscal year	Herbicides			Site preparation	
	Aerial (note a)	Ground release	Manual release	Mechanical	Manual
	(acres)				
1975	2,790	0	0	0	0
1976	7,392	380	0	0	0
1977	0	0	120	33	133
1978	0	0	515	300	49
1979	1,315	1,169	34	414	0

a/Unable to differentiate acres for release and site preparation.

Although formal evaluations had not been made of the success or failure of the methods used, BLM officials made the following comments.

--Silviculturists have regularly made informal evaluations of the effectiveness of aerial herbicide spraying programs in terms of impact on targeted vegetation and of impact on the conifer crop. Such evaluations have repeatedly confirmed the success of herbicide spraying.

--Herbicide spraying of brush for release is generally effective in 80 percent of the cases.

--Herbicide spraying for grass control generally requires retreatment in 2 years in half the cases.

--Manual treatment of vegetation generally involves vigorous resprouting--considerably more than with an effective herbicide treatment.

--A 1977 manual release project on 174 acres was considered successful inasmuch as the conifers were free to grow; however, some vigorous resprouting had occurred.

--One portion of another manual project was considered successful, but on the other portion the brush resprouted so much that retreatment with herbicides was required.

--Herbicides are more effective than manual methods, but either one's relative effectiveness depends on the target vegetation. Generally, sprayed units will require retreatment less often than those manually treated. However, with manual treatment, buffer strips do not have to be left untreated as must be done with herbicides.

As the above information shows, these two districts have used various alternatives for site preparation and release work and, according to officials, have achieved some success. However, the extent to which nonherbicide methods could be used more frequently cannot be determined because information is not readily available to determine why some projects succeeded and others failed. These districts, like the forests we visited, did not have data suitable for comparing projects.

STATE AND PRIVATE FORESTRY OFFICIALS' VIEWS

Like Service and BLM officials, State and private forestry officials we contacted generally believed that herbicides are the least costly and most effective (less resprouting) alternative for controlling competing vegetation. At the same time these agencies and companies had not extensively tested nonchemical alternatives although the State officials told us that manual release methods were being given a closer look because of public concern about herbicide use.

Officials from the two States, Oregon and Washington, and the two private timber companies, Publisher's and Weyerhauser, said that herbicides are generally used to (1) brown and dry the vegetation so that the harvested areas can be adequately burned to prepare planting sites and (2) release young timber stands from competing vegetation. They said that other than enhancing burning, herbicides are generally not needed for site preparation. These officials also said that manual release was not a large-scale, practical substitute for herbicides because of higher costs; reduced effectiveness (greater resprouting); lack of an adequate workforce; and high accident risks associated with manual methods, particularly on steep slopes.

State officials said that because of public concern about herbicides, they are looking closer at alternatives, particularly manual release. Oregon officials noted, however, that they expected herbicides to play a significant role in State vegetation management programs. At the time of our review, Oregon had awarded its first contract for manual release. The contract was scheduled for completion by May 1, 1980, and the cost compared very closely ($45 an acre) with herbicide contracts. Based on progress reports, officials estimated in April 1980 that contract performance was "undoubtedly satisfactory."

Oregon officials noted that the cost of manual release methods was less than anticipated and that the cost gap between the herbicide and manual methods was decreasing. The officials pointed out that if resprouting is a major problem, then manual release will cost more than herbicides because of the additional treatments required to gain effective release. How much more costly is unknown because Oregon officials noted, for example, that each acre treated with herbicides in the coastal areas typically needs retreatment on an average of 1.3 to 1.6 times to release a young stand of trees from competing vegetation. Washington State officials acknowledged that mechanical and manual alternatives to herbicides had not been very thoroughly evaluated.

MORE DATA NEEDED TO EVALUATE VEGETATION MANAGEMENT ALTERNATIVES

Foresters agree almost unanimously on the need for releasing conifers from competing vegetation and on chemicals as the preferred (easiest, cheapest, quickest, or most effective) method to gain that release. As a result of this reliance on herbicides, some nonchemical methods have not been widely used, evaluated, or documented. Thus, limited data exists on alternatives to herbicide use.

With the advent of phenoxy herbicides about 30 years ago, foresters were provided an economical and effective tool to accomplish vegetation management. Much research has been directed toward ways to improve chemical effectiveness--how much, how often, and when--rather than developing or improving alternative methods, especially manual methods. The heavy research emphasis on chemicals has been attributed to the relative economy and effectiveness of chemical methods over other alternatives--especially labor-intensive alternatives. Consequently, there is a dearth of cost and effectiveness data for the nonchemical alternatives. The agencies have taken action to begin closing this data gap.

The data gap

Studies have shown that conifers released from competing vegetation grow at a faster rate during the first 5 to 10 years following release than conifers on untreated plots and that herbicides have been effective to varying degrees in controlling different types of competing vegetation. However, Service and university researchers told us that only a few limited studies had been done to evaluate the use of manual release methods. They said that much more research is needed to evaluate the long-term silvicultural benefits of vegetation management in general as well as the relative cost and effectiveness of nonchemical methods. In particular, side-by-side comparisons of chemical and nonchemical alternatives for both site preparation and release are needed to test the relative advantages and disadvantages of each method or combination of methods. Critical, quantitative comparisons of currently used practices are inadequate, according to Service sources, and promising alternatives must be evaluated.

Closing the data gap

The Forest Service approved an administrative study in March 1980 to evaluate chemical and some nonchemical methods to control vegetation. The study has a national scope involving five regions and six experiment stations. Initial fieldwork for the study will take about 2 years, and follow-up monitoring and data analysis could take 10 years or even longer. This study's methodology sets it apart from historical vegetation management studies in that manual and chemical methods will be evaluated simultaneously on side-by-side test plots. This is essential if the Service is to obtain information on the relative worth of the vegetation management practices. As pointed out in other sections of this report, too many unrecorded site-specific variables are involved to permit a valid comparative analysis of land. This administrative study appears to be a step in the right direction; however, more needs to be done.

Comparative analysis data is essential if the Congress and the agencies involved are to make informed, thoughtful policy and management decisions about vegetation management. Is aerial spraying the best method? Are the other methods really more expensive? If so, how much more? If a policy decision is made to eliminate or severely curtail forest chemical use, what will be the effects? How can some of the problems associated with alternatives to herbicides be resolved? Will harvests have to be decreased or budgets increased? The administrative study will be an important beginning for obtaining answers to some of these questions.

Oregon State University is starting a program which may also help answer some of the above questions. The program, called CRAFTS (Coordinated Research of Alternative Forestry Treatments and Systems) is designed to coordinate research involving various forest vegetation management alternatives. The research will cover a wide range of forest sites, ownership categories, and management systems in the Pacific Northwest. This is a long-term research project designed to study a variety of chemical and nonchemical vegetation management alternatives.

Although we did not evaluate the role of research in vegetation management and how research priorities are set, it would seem feasible that research could help resolve some of the most common problems associated with nonherbicide alternatives. For example, a problem generally associated with manual methods is resprouting and uncertainty currently exists about whether the timing of the cutting may affect the amount of that resprouting. Although some research does exist, according to Service officials, it has generally been limited to hardwood competition in the South.

According to the Department of the Interior (see app. V), each BLM district in western Oregon has been directed to establish at least one trial site each year for alternative methods. Also, BLM is supporting Oregon State University's CRAFTS project.

CONCLUSIONS

Forests have demonstrated that alternatives to herbicides are viable; it is the extent to which they can replace herbicides that is not known and will not be known until more site-specific data is gathered on the most important factors which supposedly influence decisions on what method can or cannot be used and on the success and failure of projects whether the vegetation was treated with chemicals or some nonchemical means. Our recommendations in chapters 4 and 5 are directed toward helping to answer these questions.

CHAPTER 4

VEGETATION MANAGEMENT DECISIONS NEED IMPROVEMENT

To help fill the major information gaps on the cost and relative effectiveness of options available to carry out site preparation and release work, Service forests and BLM districts relying primarily on herbicide use to perform such work should increase the use of nonherbicide methods. Increasing the use of alternatives to herbicides would also provide practical (in the field), site-specific experience in applying these methods to the areas being managed.

In addition, both agencies need to take steps to ensure that site-specific pretreatment and post-treatment information is gathered and documented for use in determining whether alternatives to herbicides can be used more and in evaluating vegetation management decisions. Also, more objective criteria need to be developed for determining the need for release.

BLM's and the Service's recent chemical-use policy statements seem more restrictive than previous ones and imply that nonchemical alternatives should be used whenever possible. Given the subjectivity of the decisionmaking process and foresters' long-standing belief that herbicides are the safest, most economical, and most effective method available, we question whether these changes will have any significant effect on the actual number of acres treated with nonchemical methods. Both agencies have required since the early 1970s that nonchemical alternatives be considered in the decisionmaking process. Herbicide opponents and other observers contend that alternatives have not been adequately considered.

Our review of the decisionmaking process at the two BLM district offices and six forest supervisor offices demonstrated that:

--Vegetation management decisions involving herbicide use, although reviewed at various levels in both agencies, seem to be based primarily on the subjective recommendation of those managing the forests on a day-to-day basis.

--The degree to which alternatives were considered could not be measured or determined because pertinent information such as steepness of slopes, density of brush, and number of stems per acre, which is often cited as having a bearing on the decision, was generally not obtained or documented; in those cases where it was available, it was generally incomplete.

--Post-evaluations of site preparation and release work on a project-by-project basis were generally nonexistent except for two forests which performed some evaluations on herbicide projects.

AGENCY POLICIES EMPHASIZE USE OF ALTERNATIVES TO HERBICIDES

BLM's chemical pest control policy, adopted in May 1972, is stated in section 9222 of its manual as follows.

> "All proposed use of pesticides [1/] on Bureau lands will be reviewed and studied thoroughly as to possible impact each may have on the ecosystem and total environment. Said use will be avoided in the absence of demonstrated need or if there is scientific basis for belief it will result in unnecessary or excessive hazards to man or the natural environment.
>
> "All alternatives of integrated pest management must be explored. Integrated pest control methods are a combination of chemical, biological, cultural, and other methods which will minimize the adverse impact of pest control."

While BLM's policy recognized that alternatives to minimize chemical use should be explored, the Department of the Interior's policy, which is part of BLM's manual, seemed more direct in terms of using alternatives. Until September 1980 Interior's policy, also adopted in 1972, stated that safety and environmental quality were the primary factors to consider when deciding whether to use pesticides. Interior guidelines declared, among other things, that:

--No chemical pesticide should be used alone if a nonchemical or integrated chemical/nonchemical technique offered an alternative.

--Large-scale, nonspecific pesticide applications would not be made.

--Contingency plans would be developed to minimize effects of pesticide spills.

1/The term pesticides includes herbicides, insecticides, and fungicides.

--Pesticide research and control programs would be coordinated with State, local, and other Federal authorities.

Interior's September 1980 policy revision appears more restrictive in terms of emphasizing the consideration of alternatives to chemicals. It says the Department policy is:

"To use pesticides only after full consideration of alternatives - based on competent analyses of environmental effects, effectiveness, safety, specificity, and benefit/cost - demonstrating that the use of the pesticide is the least hazardous among those available and meets essential management goals. The full range of alternatives including chemical, biological, and physical methods, and no action must be considered."

To comply with the National Environmental Policy Act of 1969 (42 U.S.C. 4321), the Forest Service developed policies and guidelines to assure that an environmental assessment, which includes considering alternatives, and/or an environmental statement was part of all planning and decisionmaking activities.

The Service's current policy and guidance for pesticide use is outlined in title 2100, Environmental Management, of its manual. This section has had two major revisions since March 1978. The changes, which appear to make the policy more restrictive and imply that alternatives should be used whenever possible, emphasize evaluating alternatives, strengthening safety procedures (especially for application of phenoxy herbicides), and increasing the opportunities for public participation in the decisionmaking process.

The manual's 1978 policy statement recommended pesticide use whenever management objectives could best be achieved by this method. The policy also stated that alternatives to pesticide use were to be considered if they were "technologically available and economically feasible." In February 1979 the policy was revised to encourage an integrated pest management approach which would examine nonchemical or combined chemical/nonchemical methods as alternatives to a purely chemical solution. The current policy statement issued in October 1979 follows.

"Recommend and use pesticides only after consideration of alternatives--based on competent analyses of effectiveness, specificity, environmental impacts,

> and benefit cost--clearly demonstrates that their use is essential to meet management goals. The full range of alternatives--including cultural, mechanical, manual, prescribed fire, biological, chemical, and regulatory methods--must be considered. High priority should be given to the utilization of employment opportunity programs and other opportunities to create jobs."

The reference to employment programs seems to deemphasize aerial herbicide spraying, which requires considerably less labor compared with manual methods or ground herbicide methods.

Although both agencies' recent revisions reemphasize the importance of considering alternatives to herbicides, we question whether these changes will appreciably increase the use of nonherbicide methods as long as forest managers continue to make decisions based on existing information, which has serious gaps.

HERBICIDE USE VERSUS ALTERNATIVES

Site preparation and release work acreage data (exclusive of burning) over the 5-year period 1975-79 (the most recent figures available at the time of our review) indicates that the use of nonchemical methods in relation to chemical methods has not changed significantly. As shown in the following table, four of the eight forests and one of the two BLM districts we visited used herbicides on a greater percentage of the land treated in 1979 than in 1975, while one forest and one BLM district showed some reduction and the Shasta/Trinity forests showed a significant reduction in herbicide use. For one forest, information was not available for 1975-78. The significant reduction shown for Shasta/Trinity was due to outside influences (county ordinances) rather than management choice. It should be noted, however, that Service officials do not believe the agency is bound by the ordinances even though it is complying with them.

Vegetation Management Methods Used for Release and Site Preparation Work--1975-79 (Notes a, b)

Forest or district	1975		1976		1977		1978		1979	
	H	NH	H	NH	H	NH	H	NH	H	NH
	----(percentage of total acres treated)---									
California:										
Klamath	55	45	68	32	72	28	25	75	77	23
Shasta/Trinity	55	45	74	26	0	100	0	100	10	90
Pacific Northwest:										
Siuslaw	98	2	97	3	64	36	80	20	88	12
Willamette	0	100	0	100	0	100	17	83	28	72
Southern:										
Francis Marion/ Sumter	83	17	89	11	96	4	97	3	89	11
Ouachita	(c)		(c)		(c)		(c)		80	20
BLM: (note d)										
Eugene	100	0	100	0	0	100	0	100	85	15
Medford	0	0	97	3	83	17	0	100	70	30

a/This data does not include acreages where prescribed burning was used exclusively but may include acreages where prescribed burning was used in conjunction with herbicides. However, these acreages could not be readily identified.

b/H means herbicides; NH means nonherbicides.

c/Data not available.

d/According to the Department of the Interior, BLM's herbicide program was essentially nonoperative from 1977 through 1979 while an environmental impact statement was being prepared. (See app. V.)

ARE ALTERNATIVES TO HERBICIDES ADEQUATELY CONSIDERED IN VEGETATION MANAGEMENT DECISIONS?

Herbicide opponents and other observers charge that neither the Service nor BLM adequately considers alternatives to herbicides in the decisionmaking process. Forest officials disagree with this charge, pointing out that both agencies' policies require that alternatives be considered and that their decisions have been upheld on numerous occasions at various levels within both agencies.

Our reviews of records and discussions with officials at the districts and forest offices we visited showed that Service and BLM vegetation management decisions involving the use of herbicides, although reviewed at various levels in both agencies, seem to be based primarily on the subjective recommendations of those managing the forests on a day-to-day basis. Professional judgment will always be important in decisions regarding vegetation management; however, overemphasizing its role could affect an agency's ability to defend or justify its decisions. Although it was clear that alternatives to herbicides were considered, we could not determine why one alternative was chosen over another because pertinent information--steepness of slopes, density of brush, stems per acre--which is often cited as having a bearing on the decision was generally not obtained or documented; in those cases where it was available, it was generally incomplete.

Although the paperwork and various factors used to evaluate alternatives sometimes differed among the forests and BLM units we visited, the major factors influencing the decisions were (1) costs, (2) what was believed to be the most effective method for controlling the competing vegetation, and (3) the success of past methods. Two other beliefs which probably influenced the decisionmaking process toward herbicides and which were cited quite often were that (1) herbicides have been used for years on forest lands without any major problems noted either to humans or the crop trees and (2) these decisions must be based on local conditions--a method that works in one forest may not work in others. In those cases where herbicides were not the primary method of controlling vegetation, factors outside the agency (such as the court case and local ordinance referred to on page 9) influenced the decisions rather than any formal consideration of alternatives.

Other evidence indicates that improvements are needed in the decisionmaking process when alternatives to herbicides are considered. In an August 1980 draft report of conclusions and options for program adjustments, the Center for Natural Areas 1/ expressed the following conclusions, among

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1/In April 1979 the Forest Service contracted with the Center for Natural Areas, a nonprofit resource management firm formerly associated with the Smithsonian Institution, to evaluate the Service's pest-management activities, including weed management. The Center thus far has issued a number of reports, some in final and some in draft, under the contract.

others, regarding the Service's weed management planning and environmental analysis.

> "Professional judgement is a valuable resource of the Forest Service. However, it does not reduce the need for quantitative comparisons of pest-host relationships or alternative strategies for comparable sites.* * *
>
> "Examination of alternative management strategies in environmental analysis documents frequently appears as a justification for the selected treatment strategy rather than as an objective evaluation of alternative management practices, including a 'no action' alternative."

NEED TO CHANGE RELEASE CRITERIA

The Service's criteria for deciding whether a commercial stand of trees should be released from competing vegetation have been criticized both within and outside the Service. Critics claim that because the current criteria are vague, they have been applied inconsistently, resulting in areas being sprayed for release when it was not needed.

The Forest Service Manual, section 2476.41, states that release includes three principal operations:

--Treatments to free desired growing stock trees from brush trees that have overtopped them.

--Treatments to prevent development of brush trees that threaten to overtop desired growing stock trees.

--Removal of grass, weeds, or brush from around individual seedlings or small trees to release them from smothering under matted grass or weeds or from competition for soil moisture or shade.

Based on discussions with BLM officials, it appears that BLM may use similar criteria but the criteria are not outlined in writing.

Generally, the initial decision about the need for release at the forests and BLM districts visited was based on a "site prescription"--a detailed document which may be prepared as much as 6 years before the release is actually performed. The ultimate decision to release and the choice of method(s) to use are usually based on a visual examination of the stand to be treated and a judgment

as to whether it is being suppressed or is going to be suppressed. We were told that in most cases the judgment is based on whether the competing vegetation has overtopped or is going to overtop the desired species. BLM officials said that some areas need to be released because of competition for moisture irrespective of the size of the competing vegetation. One Service official noted that he generally recommends release only when the minimum stocking levels (250 trees per acre in this case) are not "free to grow."

A 1979 report, prepared by a team from the Siuslaw National Forest, summarized silvicultural activities, including release, as follows.

> "It was unanimously concluded by the team that reforestation and timber stand improvement efforts have been successful on the forest, but at tremendous cost in dollars. Standards varied between districts and many decisions are based upon 'gut feel' and past practice."

According to the report, the districts were using various standards to determine the need for release. These included:

--Release is done only when vegetation is a problem. It is not done in anticipation of a problem.

--Release spraying is done in anticipation of a problem rather than when the problem is at hand.

--No treatment is applied unless a problem exists (problem described as brush overtopping).

--Release is done when there is reason to believe that stocking or stocking vigor will be reduced below accepted standards.

In its June 1980 draft report on weed management and research, the Center for Natural Areas made the following statement regarding treatment criteria:

> "Foresters can demonstrate [that] significantly improved tree growth [is] experienced when competing vegetation is removed, but often cannot, on a site-by-site basis, determine quantitatively and scientifically whether or not weed management treatments are needed."

Groundwork, Inc., a nonprofit research group located in Eugene, Oregon, initiated a field survey and analysis in 1978 of 2,300 acres of public forest lands scheduled for

release by aerial herbicide spraying. Information such as tree height and growth and brush type, height, and density was gathered and compared from sample plots representing different conditions under which the conifers were growing. Essentially, the conditions were (1) competing vegetation overtopping conifers, (2) conifers growing above competing vegetation (released or free to grow), and (3) conifers growing inside, outside, or on the edge of brush patches. The study's results were presented in a 1978 preliminary report and in testimony before the Subcommittee on Forests, House Agriculture Committee, on January 3, 1980. According to the report and the testimony, most crop trees in the areas sampled and scheduled for spraying were quite healthy even when growing in the presence of brush, the presence of brush does not necessarily constitute a brush problem, and overtopped trees were not necessarily suppressed.

Is it feasible to develop more objective criteria for determining the need for release? Groundwork, Inc., believes it is possible. One overall conclusion of its study was that sites needed to be surveyed to gather site-specific information, such as tree leader growth, to determine treatment needs rather than using the "presence of brush" criterion. In commenting on the Groundwork study, Service officials told us that they agreed that more site-specific information is needed in the decisionmaking process and they now require their districts to gather such data. They also agreed that more objective criteria to determine treatment needs would be desirable. The same officials disagreed that the study showed that the acres scheduled for release did not need release. They pointed out that a number of Service research studies have shown that tree growth is stimulated when competing vegetation such as brush is suppressed.

Other Service officials also believe that better criteria are needed for deciding if certain vegetation management activities are necessary on a particular land unit. The silvicultural activity report referred to on page 39 proposed that inconsistent standards and "gut feeling" decisionmaking for various vegetation management activities should be replaced by measurable stratified standards. Although there appears to be some agreement that better criteria are needed, we are not aware of any Service plans or efforts underway to revise the existing criteria.

SITE-SPECIFIC INFORMATION BEFORE AND AFTER TREATMENT IS NEEDED

None of the BLM districts or Service forests visited consistently gathered and documented site-specific pretreatment and post-treatment information or consistently evaluated

the various treatment methods used. Such information is needed so that management can not only evaluate it decisions but also compare successful projects with failures to determine why particular methods work in some areas but not in others.

Section 2155.3 of the Service's Manual includes the following guidance for post-treatment evaluations.

--Post-treatment evaluations are required for all projects involving pesticides, except for housekeeping-type uses, field experiments, and minor uses of less than 1 pound of active ingredient for any one project. Regardless of the pesticide application method used or the size of the area treated, the effectiveness of the suppression effort must be determined.

--For vegetation control work, pretreatment and post-treatment sampling of the plant population generally will be needed.

--In some cases, a number of post-treatment evaluations should be made.

--A pesticide-use project is not complete until a post-treatment evaluation report has been completed.

--By post-treatment evaluation, the actual effects are compared with the predicted effects of the treatment on both pest and forest environment. The information gained may be used in planning future work.

BLM has no requirement for post-treatment evaluation.

Of the six forest supervisor offices visited, only two had documents showing that the post-treatment evaluations had been made. The forms varied from district to district and were often incomplete. Service and BLM officials said that, generally, informal evaluations were made.

As previously stated, site-specific information was often cited as a reason for choosing one method over another. For example, the most common reason cited for not using mechanical equipment for site preparation work was that the slopes were too steep. Generally, information on the steepness of slopes was not given, but in one case where it was given, it was apparent that some slopes were not too steep to allow use of mechanical equipment.

The number of stems per acre which have to be removed has a significant effect on the cost of manual contracts, according to Service and BLM officials. The number of stems may determine the success of a project in terms of resprouting problems--the more stems cut, the worse the resprouting. Although manual project costs per acre varied significantly (see apps. I, II, and III) and some projects were considered successful while others were cited as failures, site-specific pretreatment and post-treatment information relating to stem removals was not available to identify the reasons for differences.

CONCLUSIONS

Service forests and BLM districts relying primarily on aerial spraying and other herbicide use for site preparation and release work need to increase their use of nonherbicide methods so that options available to do this work can be thoroughly evaluated. Increased use of nonherbicide methods at these forests and districts would also help fill the major information gaps on the costs and relative effectiveness of various options; provide practical (in the field), site-specific experience in applying nonherbicide methods; provide a logical adjunct to the existing efforts in evaluating vegetation management alternatives; and better enable forests and districts to meet their management goals should the use of herbicides be further restricted.

Both agencies need to take steps to ensure that adequate site-specific pretreatment and post-treatment information is gathered and documented. Currently, such factors pertaining to local conditions, which are often cited as reasons for treatment or for selecting or eliminating a particular treatment method, are generally not documented (or identified) on a project-by-project basis. In addition to gathering post-treatment information, thorough evaluations with documentation of the success and failure of site preparation and release work are needed. These evaluations would not only help management evaluate its decisions but could also be used to compare successful projects with failures to determine why particular methods work in some areas but not in others. Pretreatment and post-treatment information could also be useful in eliminating common problems associated with certain treatment methods.

Efforts need to begin to develop more objective criteria for determining the need for release. Currently, the criteria used vary from forest to forest and within forests. Some individuals have charged and some information indicates that release sometimes may have been carried out when it was not needed.

RECOMMENDATIONS TO THE SECRETARIES OF AGRICULTURE AND THE INTERIOR

To make sure that options available to carry out site preparation and release work are thoroughly evaluated, we recommend that the Secretaries of Agriculture and the Interior instruct the Chief of the Forest Service and the Director of BLM, respectively, to ensure that:

--Those forests and districts relying heavily on herbicides increase the use of nonherbicide methods.

--Adequate site-specific pretreatment and post-treatment information is gathered and evaluated.

We also recommend that the Secretaries instruct the agency heads to develop more objective criteria for determining the need for release.

AGENCY COMMENTS AND OUR EVALUATION

The Department of Agriculture said our recommendations will strengthen the decisionmaking process on the use of herbicides for forest vegetation management. (See app. IV.)

The Department of the Interior said its vegetation management decisionmaking process should be strengthened and that it generally concurred with our recommendations. (See app. V.) It also said that a recently completed BLM evaluation of the 1980 spring herbicide program in Oregon affirmed that the established policies and guidelines were being carried out on the ground. The August 13, 1980, report which BLM provided to us was prepared by BLM field officials and a consulting forester. In commenting on selections of areas for treatment, the report stated that reforestation units were selected for inclusion in the spray program by various methods. Two districts had developed detailed site analysis forms which documented the decision process involved in prescribing vegetation management treatments, one district had plans to develop a survey form, and one district varied by resource area on whether or not a survey form was used.

In commenting on post-treatment evaluations, the report stated that post-project surveys of treatment effectiveness consisted, in some cases, of informal visual checks. No uniform system was found for recording, storing, and using this information. The report recommended that all districts implement post-treatment surveys to evaluate treatment effectiveness.

CHAPTER 5

AVAILABLE COST DATA NOT SUITABLE CRITERION FOR SELECTING AMONG VEGETATION MANAGEMENT ALTERNATIVES

A definitive analysis of vegetation management costs was not possible because some pertinent data was not available. However, the data obtained indicated that aerial herbicide spraying may not have as much of an economic advantage over other methods as is generally thought. Also, the cost differential among the methods appears to have narrowed considerably since 1975.

Although costs appeared to be a key consideration in their decisionmaking processes, the agencies generally did not make detailed cost comparisons or analyses nor keep records to track the indirect costs associated with the various vegetation management practices. If estimates obtained for 1979 indirect costs are accurate, it would appear that the case for aerial herbicide spraying is indeed overstated.

We collected actual site preparation and release contract cost data from six forests and two BLM districts. Release cost data from two other forests was based on estimates, and site preparation cost data from two other forests was based on a combination of actual and estimated data. Except for one forest, this data was gathered for fiscal years 1975-79. Usable estimates of 1979 indirect costs were obtained from six forests.

Disagreements over the costs of the various vegetation management alternatives are about as extensive as the disagreements over the methods themselves. Herbicide opponents charge that most aerial spraying cost examples cited by the Service and BLM have not included total costs--that they left out such things as "down time" for helicopters, monitoring costs, environmental statement preparation, and litigation costs. (Actually, "down time" for helicopters is considered a cost of doing business and has been included in the contract costs. It would, therefore, have been included in any analysis of vegetation management direct costs.) Some opponents have also charged that the costs cited for nonherbicide methods have been biased because the agencies have cited only those projects which had high contract costs.

A detailed analysis of the contract cost data could not be made because pertinent information which may influence contract costs was generally not available. For example, officials told us that several factors--such as height, quantity, and type of vegetation to be treated; type of

terrain; site location and its accessibility; and experience of contractors--all have a bearing on the costs per acre. Yet this data was generally not available so that one could compare or identify why costs varied so much not only when different methods were used but also when the same method was used. Also, to perform a thorough cost analysis of the methods, one must know the standards used to determine the need for treatment, the reasons one treatment method was chosen over another, and the expected and actual results. Specific information on these matters generally did not exist.

The cost data that follows is intended only to be illustrative and should not be used for definitive cost analyses. The reader is cautioned not to draw detailed conclusions about cost trends for a specific vegetation management practice or attempt to define exacting comparisons among the practices. Nevertheless, we believe the cost data we were able to gather may be indicative of what has been happening and what may happen in the future in terms of the costs of the various methods available to treat competing vegetation. Obviously, more refined cost data is needed if economics is going to play an important role in choosing one method over another.

DIRECT CONTRACT COST DATA INDICATES THAT PER-ACRE COST DIFFERENCES AMONG TREATMENT METHODS MAY BE NARROWING

Average site preparation and release costs per acre for all the alternatives used have generally increased since 1975. (See charts 1 and 2, p. 46.) However, the cost variances among the methods narrowed considerably during this time. 1/ (See charts 3 and 4, p. 47.) The total site preparation cost variance in 1975 was 461 percentage points. The variance, peaking in 1977 at 773 points, declined dramatically by 1979 to 84 points. The variance for average release costs followed the same pattern, peaking in 1977 at 671 and declining to 108 points by 1979. This data seems to indicate that the cost per acre spread of the various methods available to treat competing vegetation may be narrowing, thus reducing the importance of

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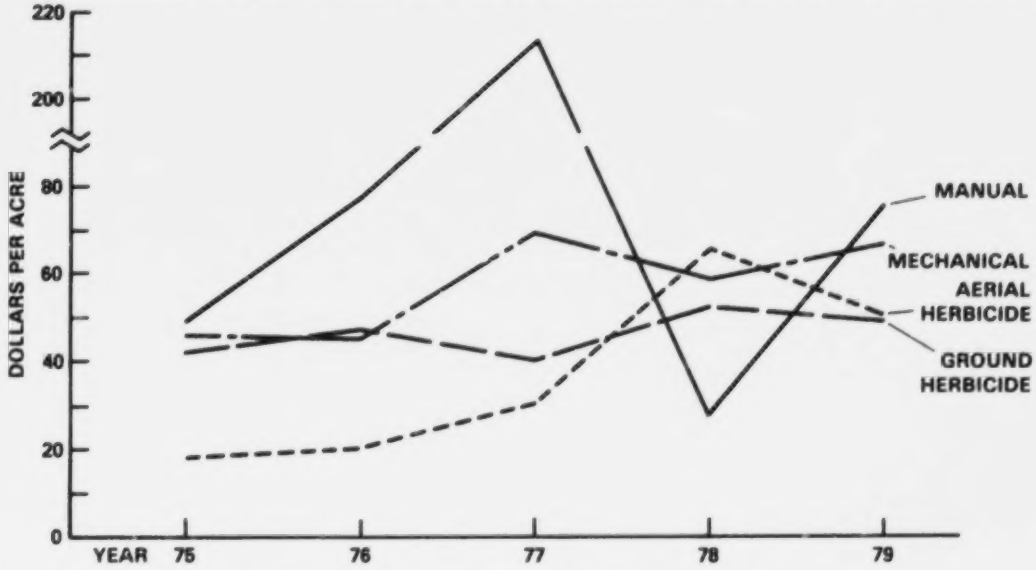
1/ The charts on page 47 use the costs of aerial herbicide application as the base for comparing costs (aerial herbicide application = 100 percent). Variance is measured as the total of the differences between the aerial application method and each nonaerial method. For example, chart 4 shows that in 1976 ground herbicide costs exceeded aerial costs by 105 percent and manual costs were 174 percent greater. Aggregate variance is, therefore, 279 percent.

CHART 1
AVERAGE DIRECT SITE PREPARATION COSTS BY ACCOMPLISHMENT METHOD (Note a)



a/1977 MANUAL DATA REPRESENTS THREE CONTRACTS WHICH TOTALED 16 ACRES.

CHART 2
AVERAGE DIRECT RELEASE COSTS BY ACCOMPLISHMENT METHOD

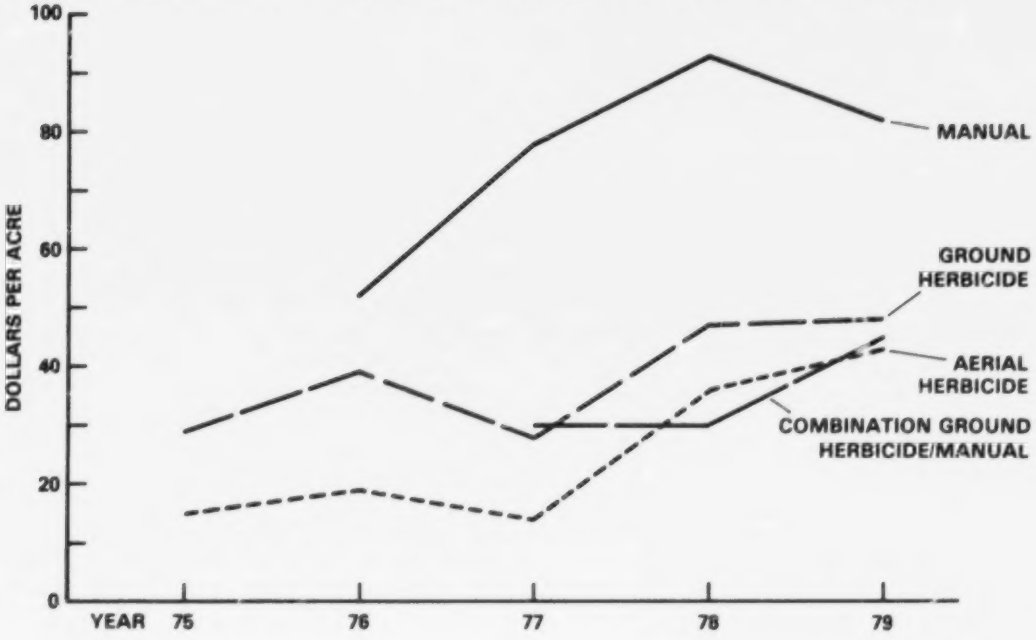
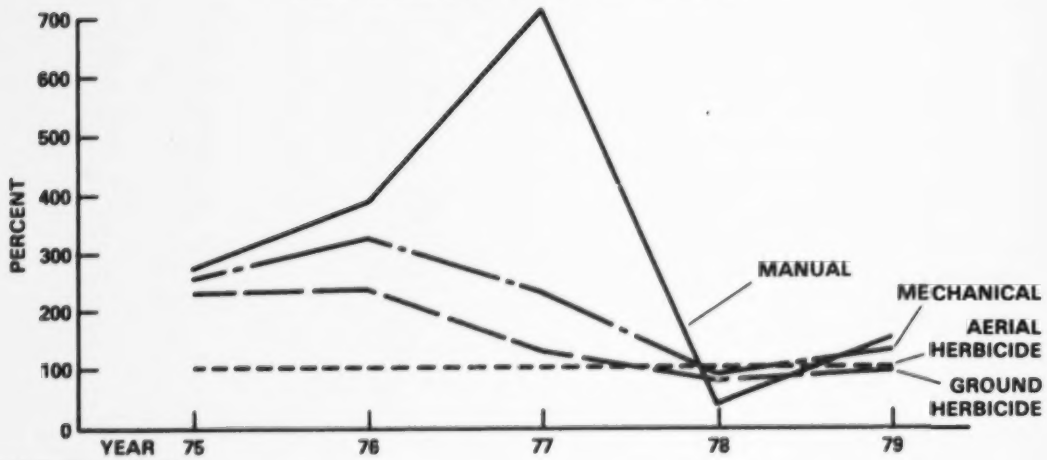


CHART 3
COMPARISON OF AVERAGE DIRECT SITE PREPARATION COST (Note a)
(AERIAL HERBICIDE SPRAYING = 100)

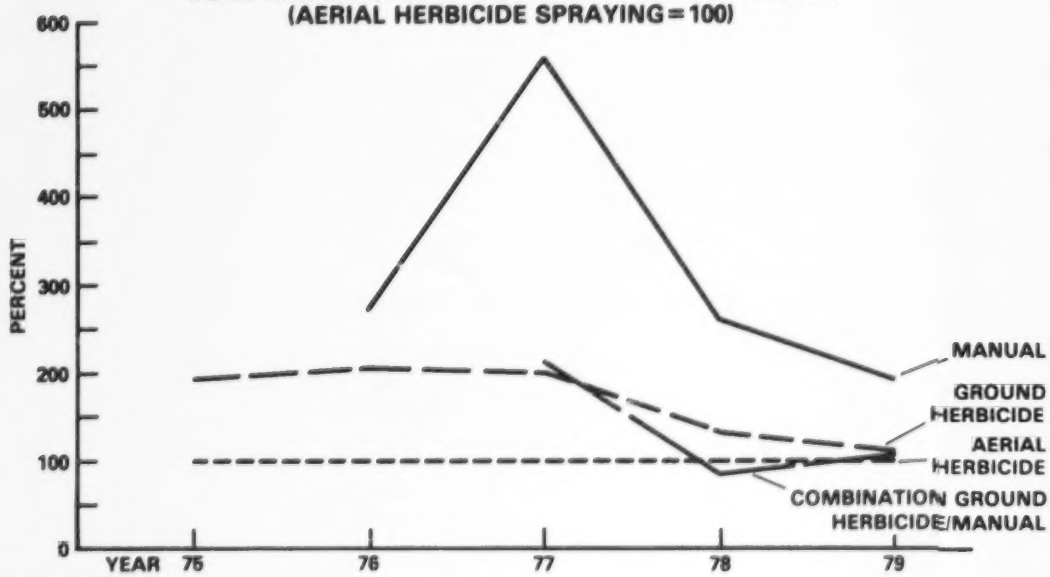


AGGREGATE VARIANCE OF ALL METHODS (Note b):	461	545	773	88	84

a/1977 MANUAL DATA REPRESENTS THREE CONTRACTS WHICH TOTALED 16 ACRES.

b/NUMBERS REPRESENT TOTAL OF ABSOLUTE COST DIFFERENCES BETWEEN THE AERIAL APPLICATION METHOD AND EACH NONAERIAL METHOD.

CHART 4
COMPARISON OF AVERAGE DIRECT RELEASE COSTS
(AERIAL HERBICIDE SPRAYING = 100)



AGGREGATE VARIANCE OF ALL METHODS (NOTE a):	93	279	671	206	108

a/NUMBERS REPRESENT TOTAL OF ABSOLUTE COST DIFFERENCES BETWEEN THE AERIAL APPLICATION METHOD AND EACH NONAERIAL METHOD.

budgetary outlays as an issue in deciding which method to use. (See apps. I and II for detailed costs per acre by forest and the dollar ranges.) Service officials point out that these are costs for a single treatment and not a measure of cost effectiveness since the number of treatments may vary from method to method. This is certainly true, but a better picture of actual cost effectiveness will not be known until additional comparative data is obtained through research and practice in the field.

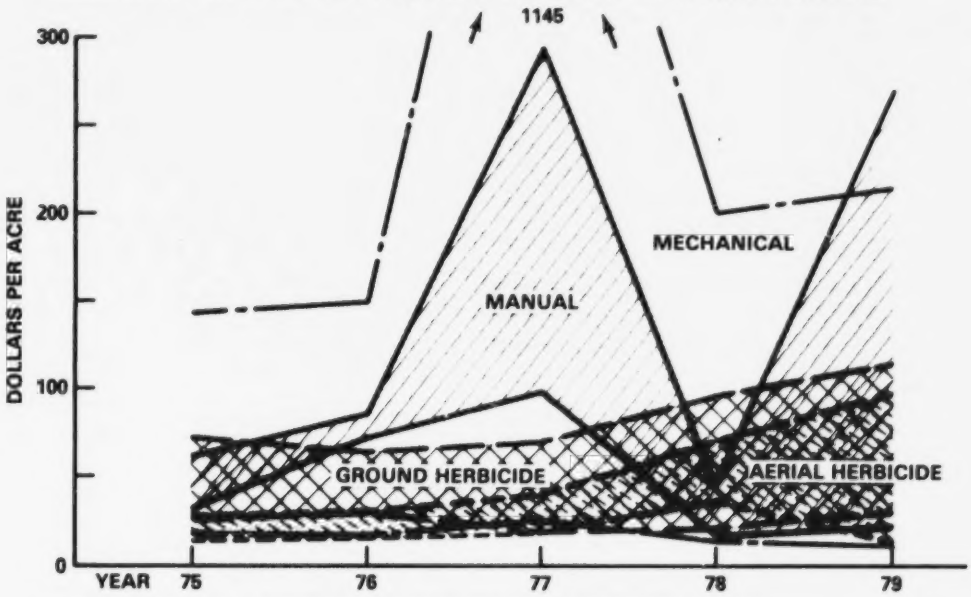
Charts 5 and 6 (see p. 49) show the ranges of direct costs for the various accomplishment methods. For site preparation, the manual and mechanical methods have the greatest ranges and are more erratic than other methods. At the other extreme, the combined ground herbicides/manual release method has the most consistent cost pattern. There is no doubt that wide cost ranges exist for most treatment methods, but it is not possible, using Service records, to determine why these conditions exist or what significance, if any, to attach to them. Cost variances do, however, demonstrate the need for gathering much more site-specific data for the various alternatives used for site preparation and release work if economics is to be a criterion for selecting alternatives.

TOTAL COST DATA INDICATES LESS PER-ACRE COST SPREAD FOR VARIOUS TREATMENT METHODS THAN DIRECT COST DATA

None of the forests visited during our review maintained records to track indirect vegetation management costs by the various methods used. We did, however, obtain usable estimates from Service officials at six forests. These estimates, as a percentage of total costs, varied considerably. For aerial herbicide spraying, the estimates ranged from 23 percent to 70 percent of total costs. For nonaerial methods, they ranged from 5 percent to 48 percent.

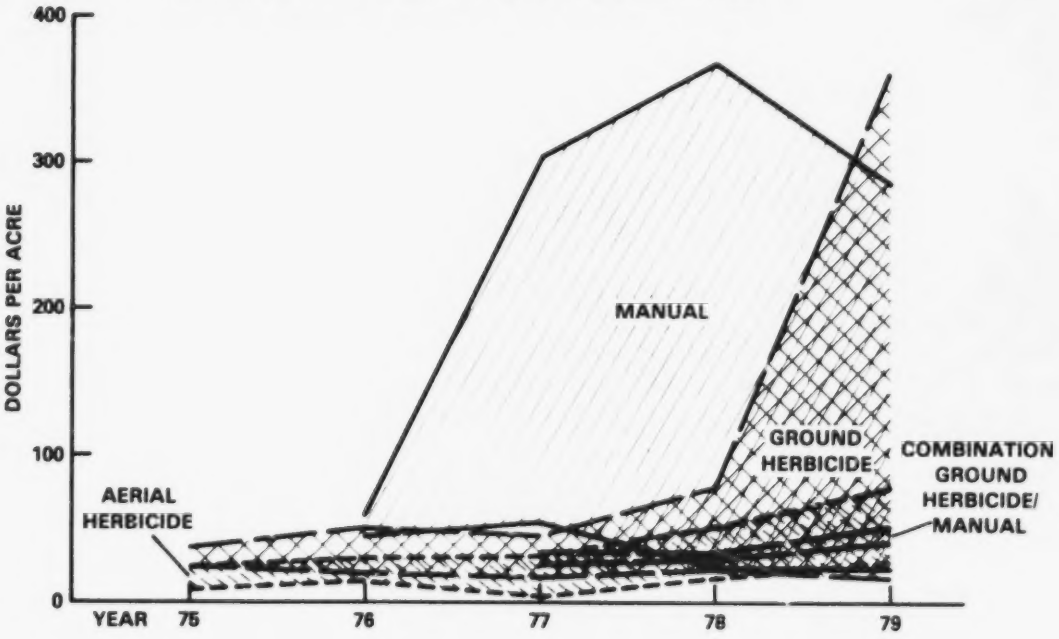
Charts 3 and 4 on page 47 show the relative positions in 1975-79 of various management methods' direct costs for eight forests. The charts generally show an increasingly favorable trend for nonaerial methods. When the 1979 total (direct plus indirect) costs are compared in this manner, the comparison is even more favorable. (See the table on p. 50.) In every case but one, the total cost figure for nonaerial methods compares more favorably with the aerial application method than when only direct costs are considered. For example, manual release is 91 percent more expensive than aerial release when comparing direct contract costs but only 29 percent more expensive when comparing total costs. If these figures are indicative of overall Service cost

CHART 5
RANGE OF DIRECT SITE PREPARATION COSTS BY METHOD (Note a)



a/1977 MANUAL DATA REPRESENTS THREE CONTRACTS WHICH TOTALED 16 ACRES.

CHART 6
RANGE OF DIRECT RELEASE COSTS BY METHOD



relationships, economic factors could become decreasingly important in selecting future vegetation management alternatives.

Comparison of 1979 Average Vegetation Management Costs
(Aerial application = 100%)

Method	Direct costs (note a)	Total costs (note b)
	(percent)	
Site preparation:		
Aerial	100	100
Manual	150	112
Mechanical	132	121
Ground herbicide	98	77
Release:		
Aerial	100	100
Manual	191	129
Ground herbicide	112	121
Combination: Ground herbicide/ manual	105	74

a/Based on cost data (actual and/or estimated) from eight forests.

b/Based on actual, direct cost data and usable indirect cost estimates from six forests.

The list of indirect cost elements differed for each forest. The estimates included such things as law enforcement, water monitoring, water tests, contract layout, vehicles, training, and public relations. Also mentioned were damages to a Service vehicle and contract termination penalties. Litigation costs for the most part were unavailable.

Two aerial spray contracts had been terminated for the convenience of the Government. One claim was pending at the time of our fieldwork; the other had been settled for nearly $27,000. The decision on what items should be included in indirect costs is very important since the cost per acre, not including the $27,000 penalty, is $20; including the penalty raises the cost to $90 an acre.

BLM COST DATA

The vegetation management cost data we obtained from the two BLM districts is shown in appendix III by the average release and site preparation costs as well as the range of

costs. Because the data involved only a few contracts, we did not reach any conclusions. However, like the Service data, costs per acre varied considerably by method and among the different methods.

CONCLUSIONS

The agencies do not know the total costs for the various methods used to carry out site preparation and release work and cannot, therefore, reliably use cost as the major determinant for selecting among alternative methods.

Aerial spraying has generally been regarded as the least expensive alternative. Even though the data gathered does not permit a thorough evaluation of the relative costs for each vegetation management practice, the data does indicate that aerial spraying may not have as much of an economic advantage over other methods as is generally thought.

RECOMMENDATION TO THE SECRETARIES OF AGRICULTURE AND THE INTERIOR

Recognizing the shortcomings in current cost data documentation, we recommend that the Secretaries of Agriculture and the Interior instruct the Chief of the Forest Service and the Director of BLM, respectively, to gather more comprehensive and complete cost data on their site preparation and release projects.

AGENCY COMMENTS

The Department of Agriculture said our recommendation would strengthen the forest management decisionmaking process pertaining to herbicide use. (See app. IV.)

The Department of the Interior said it concurred with our recommendation. (See app. V.)

FOREST SERVICE SITE PREPARATION COSTS PER ACRE, 1975-79 (Note a)

Year/method	Siuslaw Avg.	Siuslaw (Range)	Klamath Avg.	Klamath (Range)	Willamette Avg.	Willamette (Range)	Ouachita (note b) Avg.	Ouachita (note b) (Range)	Sumter and Francis Marion (note c) Avg.	Sumter and Francis Marion (note c) (Range)	Shasta-Trinity Avg.	Shasta-Trinity (Range)
	(dollars per acre)											
1975:												
Aerial	18	(14-27)	—	—	—	—			—	—	—	—
Manual	—	—	—	—	—	—			49	(32-62)	—	—
Mechanical	97	(97)	51	(22-144)	85	(83-86)			40	(36-54)	40	(18-123)
Ground herbicide	—	—	—	—	—	—			42	(27-72)	—	—
GH/Manual	—	—	—	—	—	—			—	—	—	—
1976:												
Aerial	19	(15-30)	17	(16-18)	—	—			—	—	24	(24)
Manual	—	—	85	(85)	—	—			72	(72)	—	—
Mechanical	149	(149)	41	(17-97)	100	(93-105)			44	(39-53)	45	(24-125)
Ground herbicide	—	—	—	—	—	—			47	(30-63)	—	—
GH/Manual	—	—	—	—	—	—			—	—	—	—
1977:												
Aerial	30	(18-40)	—	—	—	—	—	—	—	—	—	—
Manual	98	(98)	—	—	—	—	—	—	—	—	239	(150-295)
Mechanical	947	(746-1145)	118	(89-127)	107	(94-126)	60	(48-85)	45	(38-54)	47	(25-175)
Ground herbicide	—	—	—	—	—	—	24	(18-33)	55	(41-70)	—	—
GH/Manual	—	—	—	—	—	—	32	(32)	—	—	—	—
1978:												
Aerial	65	(36-71)	—	—	—	—	—	—	—	—	—	—
Manual	—	—	—	—	—	—	28	(21-47)	27	(15-32)	—	—
Mechanical	—	—	71	(25-137)	134	(100-200)	54	(37-75)	69	(59-74)	46	(14-143)
Ground herbicide	—	—	—	—	—	—	25	(21-31)	66	(51-96)	—	—
GH/Manual	—	—	—	—	—	—	—	—	—	—	—	—
1979:												
Aerial	72	(57-97)	19	(14-45)	31	(31)	—	—	—	—	—	—
Manual	—	—	—	—	84	(68-268)	22	(22)	—	—	209	(209)
Mechanical	—	—	68	(28-173)	76	(76)	70	(30-82)	63	(54-78)	62	(12-214)
Ground herbicide	—	—	—	—	—	—	34	(26-48)	55	(35-112)	99	(79-114)
GH/Manual	—	—	—	—	—	—	66	(66)	—	—	—	—

a/Based on actual contract costs from six forests and a combination of estimated and actual costs from two forests. Averages weighted on basis of number of acres.

b/Data not available for 1975 and 1976.

c/Costs include both actual contract costs and estimated costs.

APPENDIX I

FOREST SERVICE RELEASE COSTS PER ACRE, 1975-79 (Note a)

Year/method	Siuslaw		Klamath		Willamette		Ouachita (note b)		Sumter and Francis Marion (note c)		Shasta-Trinity	
	Avg.	(Range)	Avg.	(Range)	Avg.	(Range)	Avg.	(Range)	Avg.	(Range)	Avg.	(Range)
	(dollars per acre)											
1975:												
Aerial	18	(14-24)	8	(8)	—	—	—	—	—	—	15	(15-17)
Manual	—	—	—	—	—	—	—	—	—	—	—	—
Ground herbicide	—	—	—	—	—	—	—	—	29	(24-37)	—	—
GH/Manual	—	—	—	—	—	—	—	—	—	—	—	—
1976:												
Aerial	14	(13-18)	17	(15-30)	—	—	—	—	—	—	17	d/(15-22)
Manual	52	(45-60)	—	—	—	—	—	—	—	—	—	—
Ground herbicide	—	—	—	—	—	—	—	—	39	(20-50)	—	—
GH/Manual	—	—	—	—	—	—	—	—	—	—	—	—
1977:												
Aerial	20	(18-21)	13	(3-31)	—	—	—	—	—	—	—	—
Manual	73	(59-85)	—	—	—	—	—	—	—	—	115	(54-300)
Ground herbicide	—	—	—	—	—	—	17	(17)	40	(31-45)	—	—
GH/Manual	—	—	—	—	—	—	30	(25-34)	—	—	—	—
1978:												
Aerial	38	(23-52)	29	(21-37)	20	(17-22)	—	—	—	—	—	—
Manual	66	(24-218)	145	(80-366)	170	(98-275)	—	—	—	—	181	(160-225)
Ground herbicide	—	—	—	—	—	—	—	—	47	(22-78)	—	—
GH/Manual	—	—	—	—	—	—	30	(29-34)	—	—	—	—
1979:												
Aerial	42	(28-79)	47	(41-52)	28	(28)	—	—	—	—	—	—
Manual	111	(66-190)	285	(285)	76	(24-123)	36	(36)	—	—	—	—
Ground herbicide	101	(29-356)	131	(75-145)	—	—	46	(42-53)	25	(17-61)	—	—
GH/Manual	—	—	—	—	—	—	45	(42-52)	—	—	—	—

a/Based on actual contract costs from six forests and estimated costs from two forests. Averages weighted on basis of number of acres.

b/Data not available for 1975 and 1976.

c/Estimated costs.

d/One contract canceled at convenience of the Government. If the penalty for the cancellation is included, then the average cost is $22 and the range is ($15-90).

APPENDIX II

BUREAU OF LAND MANAGEMENT

VEGETATION MANAGEMENT CONTRACT COSTS FOR TWO DISTRICTS

Year/method	Release				Site preparation			
	Eugene		Medford		Eugene		Medford	
	Avg.	(Range)	Avg.	(Range)	Avg.	(Range)	Avg.	(Range)
	(dollars per acre)							
1975:								
Aerial (note a)	21	(21)	--	--	21	(21)	--	--
Manual	--	--	--	--	--	--	--	--
Ground herbicide	--	--	--	--	--	--	--	--
Mechanical	--	--	--	--	--	--	--	--
1976:								
Aerial (note a)	16	(16)	18	(18)	16	(16)	19	(19)
Manual	--	--	--	--	--	--	--	--
Ground herbicide	79	(38-84)	41	(41)	--	--	--	--
Mechanical	--	--	--	--	--	--	140	(140)
1977:								
Aerial	--	--	19	(19)	--	--	20	(20)
Manual	145	(145)	--	--	38	(24-44)	336	(300-416)
Ground herbicide	--	--	--	--	--	--	--	--
Mechanical	--	--	--	--	187	(187)	137	(137)
1978:								
Aerial	--	--	--	--	--	--	--	--
Manual	97	(77-124)	--	--	42	(22-62)	--	--
Ground herbicide	--	--	--	--	--	--	--	--
Mechanical	--	--	--	--	125	(125)	111	(89-200)
1979:								
Aerial (note a)	50	(50)	28	(24-30)	50	(50)	28	(28)
Manual	163	(163)	--	--	--	--	--	--
Ground herbicide	63	(45-81)	--	--	--	--	--	--
Mechanical	--	--	--	--	93	(93)	138	(119-238)

a/Eugene District data for 1975, 1976, and 1979 did not distinguish between aerial site preparation and release. The data is included in both columns.

APPENDIX IV

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

P.O. Box 2417
Washington, DC 20013

05 FEB 1981

2150

Mr. Henry Eschwege
Director, Community and
Economic Development Division
U.S. General Accounting Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Eschwege:

Thank you for providing us the opportunity to review and comment on the draft of your proposed report to Senator Mark O. Hatfield and Congressman Jim Weaver titled "Herbicides for Managing Vegetation on Forest Lands: Many Questions, Few Answers."

We have reviewed the draft document and before making several specific comments, we would like to commend the authors of the draft on their beneficial review of selected Forest Service vegetation management activities. Furthermore, we appreciate the participation of Mr. Larry Goldsmith and Mr. Ron Owen in an informal discussion of the draft with Forest Service personnel on January 21, which resulted in clarification of selected portions of the document. The willingness of your personnel to acknowledge and accommodate suggested changes has, we believe, resulted in a more factual document and one which recommends certain action which will strengthen the Department of Agriculture's decisionmaking process on the use of herbicides for forest vegetation management.

To further strengthen the document, you may wish to have your staff further analyze the specific comments enclosed with this letter.

Sincerely,

For R. MAX PETERSON
Chief

Enclosure

ATTACHMENT 1/

Specific Comments on Draft GAO Document "Herbicides For Managing Vegetation on Forest Lands: Many Questions, Few Answers."

Page 1, paragraph 2. Delete "one of the most widely used methods." While it is true that herbicides are used in a variety of vegetation management activities around the country, in comparison to all other vegetation management practices, it constitutes a minor portion in that less than one-tenth of 1 percent of National Forest System lands are treated with herbicides in any given year.

[GAO note: Sentence revised. However, the statement that "less than one-tenth of 1 percent of National Forest System lands are treated with herbicides in any given year" is not germane. The term "National Forest System lands" describes nearly 187 million acres of land administered by the Forest Service under the concept of multiple use for such diverse purposes as wood, water, wildlife and fish, forage, wilderness, and outdoor recreation. Herbicide use is not evenly distributed throughout the entire National Forest System nor even within intensely managed commercial forest lands. As pointed out on page 5, 70 percent of the herbicides used on Service lands is concentrated in three of the Service's nine regions. Additionally, the statement does not adequately convey the relative importance of herbicide use to the Service's vegetation management program. The data collected from eight forests in three regions shows that in over half the reported cases, herbicides constituted more than 70 percent of their site preparation and release programs between 1975 and 1979. (See p. 36.)]

Page 2, paragraph 1. Rephrase described activity as "stand maintenance including release."

[GAO note: Sentence revised.]

1/This portion of the Department's letter was retyped to facilitate showing our comments. The page numbers were changed to reflect those in the final report.

Page 6, paragraph 3. Clarify the point that although risks versus benefits are being dealt with in the 2,4,5-T cancellation hearings, it is not expected that the hearings will resolve all risk versus benefit questions since the hearings are specific to the two phenoxies involved. Risk versus benefits of other herbicides (pesticides) is done on a case-by-case basis as addressed in reviews of pesticides under EPA's Rebuttable Presumption Against Registration process.

[GAO note: Sentence revised.]

Page 9, paragraph 1. Clarify the point that on the Ouachita National Forest aerial herbicide applications ceased when the method of forest regeneration moved from aerial seeding to hand planting.

[GAO note: Sentence revised.]

Page 9, paragraph 1. Point out the fact that in Oregon's November 4 General Election, voters in Lincoln County, within which the Siuslaw National Forest occurs, decisively defeated two anti-herbicide initiatives by margins of 61 to 64 percent.

[GAO note: Information added on p. 7, paragraph 2, and p. 9, paragraph 1, fifth item. According to the clerk for Lincoln County, Oregon, votes against the initiatives exceeded votes for them by 23 and 31 percent.]

Page 10, paragraph 1. Reorganize paragraph to relate the fact that long delays have occurred and that in at least one case a damage payment was made.

[GAO note: Sentence revised.]

Page 22, last paragraph. Reexamine worksheets to determine if reason for retreatment was identified. Lack of efficacy with a new material is suspected and, if so, this should be reported. Also recommend changing last line to read "minor control of the competing vegetation" rather than "minor damage to . . ."

[GAO note: Material used was 2,4-D with diesel fuel which is not a new formulation. Sentence relating to "minor damage" revised.]

Page 42, paragraph 2. Reevaluate sentence ending at top of page to determine meaning of "to the peculiarities of their areas." Unless a specific meaning is intended this phrase can be omitted.

[GAO note: Sentence revised.]

UNITED STATES DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
Washington, D.C. 20240

February 26, 1981

Mr. Henry Eschwege
Director, Community and
Economic Development Division
General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Eschwege:

Thank you for the opportunity to review the draft report on the use of herbicides in forest management, and for delaying preparation of the final report several days to permit a more meaningful review of policy issues by the new Administration.

[GAO note: Although the Department did not submit its comments within the requested 30-day comment period, we did not delay processing the final report in order to incorporate them. The comments were incorporated simultaneously as the report was undergoing review.]

We concur that the Department's vegetative management decisionmaking process should be strengthened. Since the Department's decision to continue vegetation management with limited use of herbicides on March 19, 1979, Interior has made progress in this regard. The effort to implement the March 1979 decision continues, and we expect the decision process will improve as more information on nonchemical alternatives becomes available.

We generally concur with the recommendations in your report. However, the body of the report does not reflect the implementation efforts of the Bureau of Land Management (BLM) since the March 1979 decision.

[See GAO note under chapter 4 comments on p. 62.]

GAO NOTE: The Department's letter was retyped to facilitate showing our comments. The page numbers were changed to reflect those in the final report.

Most significantly, the report does not properly portray public concerns regarding the herbicide question. That is, the report reflects only the concerns of the opponents of herbicides. We recommend substantial rewriting of portions of the report and offer comments on each chapter to assist in this effort.

[See GAO note under chapter 2 comments below.]

Chapter 1

This chapter appears to be an adequate description of the process and status of forest management in regard to herbicides. One statement on page 5, in the second sentence, needs correction by deleting the State of Washington, where the use of herbicides by the Bureau of Land Management is negligible.

[GAO note: Washington deleted.]

Chapter 2

While we agree that the herbicide controversy has greatly affected forest management decisions, this chapter reflects only the concerns of the opponents of herbicides. Over the past year, the Department has received much correspondence urging the continuation of the safe use of herbicides in forest management. For example, we have received a 1,600-signature petition from one District alone. The concerns of the proponents should also be stated.

[GAO note: We disagree with the Department's statement that the chapter reflects only the concerns of opponents of herbicides. For example, the report states that the agencies claim that herbicides are safe, if used properly, and beneficial (see p. 7) (we believe the agencies are proponents of herbicides); notes the defeat of referenda banning herbicide use in two California counties (see p. 9); and discusses studies which have attempted to quantify the benefits of using herbicides (see pp. 10 to 12). These same statements were included in the draft report. The Department's statement on the 1,600-signature petition has been added on p. 7.]

The fact that a ground swell in proponents of herbicide use easily defeated a referendum in Oregon to ban aerial

application should be noted. The proportion of forestry use to agricultural use of herbicides should also be discussed in this chapter. For these reasons, we feel that the conclusions drawn in Chapter 2 do not accurately reflect the feelings of the general population.

[GAO note: Statement on referendum added on p. 9. We disagree with the Department that the proportion of forestry use to agricultural use of herbicides should be discussed. Our review and the report were directed toward the controversy involving the use of herbicides on forest lands. If the Department is implying that forestry use of herbicides is somehow justified based on agricultural use of herbicides, we question such thinking. According to the Department's September 1980 policy revision, herbicides are to be used only after full consideration of alternatives based on competent analyses of environmental effects, effectiveness, safety, specificity, and benefit/cost. We do not see where agricultural use of herbicides has any bearing on the matter. See p. 13 for our comments on the Department's statement that the conclusions in chapter 2 do not reflect the feelings of the general population.]

Chapter 3

We do not agree with the footnote on page 14 which states that prescribed burning is being used as much as possible. Burning is a viable alternative that is increasing in use. Technology and procedures are being changed and implemented, and the effectiveness of fire is increasing. Fire is a promising alternative in the reduction of the use of herbicides. In this light, we have recently hired two specialists in prescribed burn technology to further this effort.

[GAO note: Footnote revised to reflect the Department's position.]

Also, paragraph 2 indicates that further restrictions or bans on the use of herbicides could have some reducing effect on timber supplies. Any significant restriction or ban would definitely reduce timber supplies from BLM forests immediately.

[GAO note: Statement added on p. 14 to reflect the Department's opinion.]

Chapter 4

The National Environmental Policy Act requires that all major Federal actions be carried out only after a full assessment of the impacts has been completed. The BLM completed an Environmental Impact Statement (EIS) for the use of herbicides in 1978. Based on this document and public comments, the Secretary of the Interior issued a policy decision in March 1979 providing for limited use of herbicides. The BLM Director implemented this decision and stressed that alternative methods to the use of herbicides be thoroughly and fairly considered. Also, the Director mandated that ongoing efforts be increased to learn more about nonchemical methods of vegetative management through contracts and experimental means. The implementation requires a tract-by-tract review of vegetative management needs and an analysis of alternative methods to be used. In addition, the implementation requires adequate public participation.

Improvements have been made in vegetative management decisions made by BLM since the spring of 1979. Each BLM District in western Oregon prepares a site specific Environmental Analysis (EA) on the proposed vegetative control program. This draft EA is subjected to public review in addition to rigorous internal review to insure that alternative methods are thoroughly and fairly considered. As a result of these processes, the actual acreage treated with herbicides is significantly less than the 74,400 acres which was considered the typical annual herbicide program analyzed in the EIS. The actual acreage treated with herbicides by year was approximately 14,000 acres in 1979, and 16,000 acres in 1980. The 1980 herbicide treatment figure represents about 40 percent of the total vegetation treatments.

[GAO note: The Secretary's March 1979 policy decision stated that in implementing the vegetation management program outlined in the EIS, alternate herbicides should be substituted for the chemical silvex. Because silvex had already been banned by EPA, and the Secretary--in reaching this decision--rejected three options which would have reduced or eliminated herbicide use, we do not share the Department's view that this policy decision is an example of "providing for limited use of herbicides."

[As pointed out on page 33, BLM policy has stated since May 1972 that all alternatives of integrated pest management must be explored and pesticide use will be avoided in the absence of demonstrated need. Further, chemical pesticides should not be used alone when nonchemical or integrated chemical and nonchemical techniques offer an alternative. The EIS, developed under this policy, recommended that about 74,400 acres be treated with herbicides each year during the next 10 years. It would appear that either BLM did not follow its own precepts about minimizing herbicide use in developing the EIS or that the criteria for determining "demonstrated need" have changed substantially. In either case, the accuracy of the EIS figures can certainly be questioned, and we do not believe that the 74,400-acre annual spray figure can be used as a valid benchmark to judge the effectiveness of a stronger herbicide-use policy. A more meaningful yardstick is actual use data, but it is too early to tell what effect the most recent policy change (September 1980) will have on actual use.]

Your draft report reviewed the program from 1975-1979, but failed to recognize that the BLM herbicides program was essentially nonoperative from 1977 through the spring of 1979, while the EIS and the decision document on this program were being prepared. This omission has created a warp in your table on page 36 and led to erroneous conclusions.

[GAO note: The table was redesigned and the paragraph preceding it was rewritten after the draft was sent to the agencies for comment. A footnote has been added to the table in response to the comment above. However, the conclusions in chapter 4 remain unaffected by these changes.]

The Bureau recently completed an evaluation of its spring, 1980 herbicide program in western Oregon. Contrary to your draft report, it indicated adequate site specific pretreatment information is gathered and evaluated. However, as your report indicates, considerable effort is needed to insure that adequate site specific posttreatment information is gathered and evaluated. The BLM is working to improve this aspect of the program.

[GAO note: Information added on p. 43 to reflect BLM's recent evaluation. However, the evaluation indicated only two of the four districts had gathered adequate site-specific pretreatment information.]

The draft report does not reflect the improved decision-making processes used by BLM since the implementation of our new policy, with the concomitant reduction of herbicide use in the forestry program.

[GAO note: As stated above, we do not consider the March 1979 policy decision to signal a change in herbicide-use emphasis or procedures, and it is too soon to tell the effects of the September 1980 policy revision. Additionally, the data from two districts included in our review shows an aggregate increase in herbicide use from 1979 to 1980--not a reduction. The Medford district sprayed 2,142 acres more in 1980 while the Eugene district sprayed 309 acres less.]

Chapter 5

As previously indicated, the Department has recognized the need to learn more about nonchemical alternatives for vegetation management. The BLM has strengthened its efforts as shown in Appendix III of your draft report. To accelerate this effort further, each BLM District in western Oregon has been directed to establish at least one trial site each year for alternative methods. BLM is also supporting research efforts in this area, e.g., Coordinated Research of Alternative Forestry Treatments and Systems (CRAFTS) and Forestry Intensified Research (FIR).

[GAO note: Information added on p. 31.]

We agree that the total actual costs of the various methods used to carry out site preparation and release work are not known. As you recommended in your conclusion and as we have previously indicated in this letter, the Department is working to close that information gap. While cost is one of several determinants for selecting among alternatives, probability of effectiveness is as much and perhaps more significant.

In the review time permitted, we were not able to confirm the various figures quoted in the document. We will, however, inform you if significant discrepancies are found.

We ask that you take these comments into consideration, and that the document be changed to reflect these concerns. Changes should also be reflected in the Digest and Summary sheets.

Again, thank you for your review of herbicides use in forest management and for considering our suggested revisions to your report.

Sincerely,

/s/

Deputy Assistant Secretary--
Land and Water Resources

(021870)